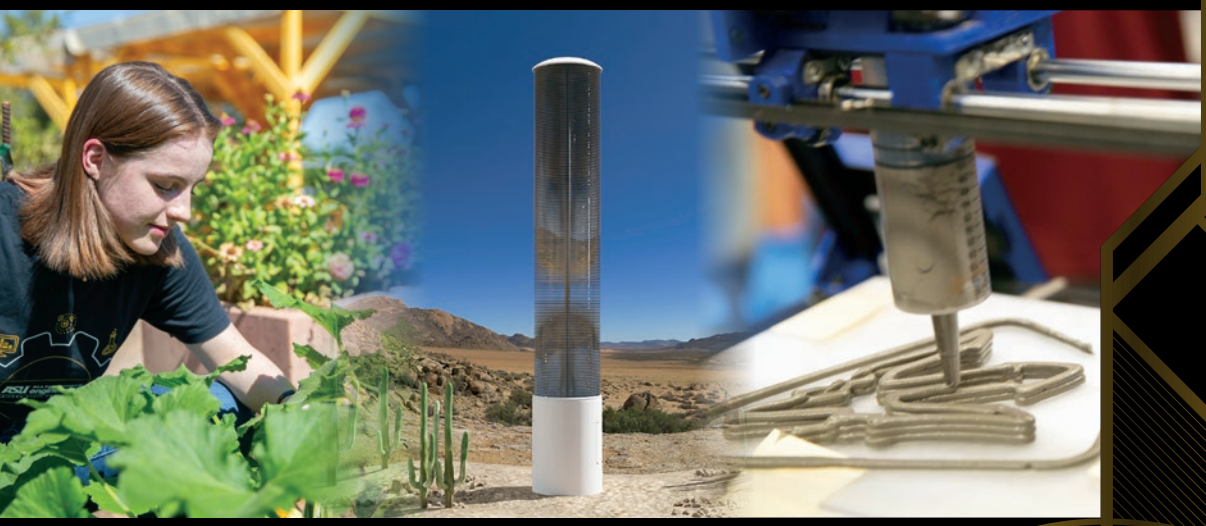
SCHOOL OF Sustainable Engineering and the Built Environment

Engineering a **Sustainable** and **Healthy** Future…

Accelerated



Ira A. Fulton Schools of Engineering
Arizona State University

2020
The Year In Review

The Ira A. Fulton Schools of Engineering at Arizona State University Offers

Ira A. Fulton Schools of Engineering
Arizona State University

25 undergraduate programs and 50 graduate programs in its six schools

SSEBE
School of Sustainable Engineering and the Built Environment

Ram Pendyala, Director

CIDSE
School of Computing, Informatics, and Decision Systems Engineering

Sandeep Gupta, Director

ECEE
School Of Electrical, Computer and Energy Engineering

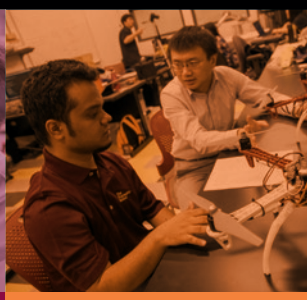
Stephen Phillips, Director

SEMTE
School for Engineering of Matter, Transport and Energy

Lenore Dai, Director

SBHSE
School of Biological and Health Systems Engineering

Marco Santello, Director



TPS
The Polytechnic School

Ann McKenna, Director

ASU named #1 in innovation for 6th consecutive year.

#1 in the U.S. for innovation
ASU ahead of MIT and Stanford
– U.S. News & World Report, 6 years, 2016–2021

BEST COLLEGES USNews MOST INNOVATIVE 2021

Research Centers

National Science Foundation Engineering Research Centers (ERCs)

Center for Bio-mediated & CBBG Bio-inspired Geotechnics

Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) – Lead, ASU

NEWT

Nanotechnology Enabled Water Treatment Systems (NEWT) – Partner, ASU

Additional Research Centers

Arizona Center for Algae Technology and Innovation (AzCATI)

Biodesign Center for Environmental Health Engineering

Biodesign Center for Health Through Microbiomes (BCHTM)

Center for Environmental Security (CES)

Center for Negative Carbon Emissions (CNCE)

Center for Teaching Old Models New Tricks (TOMNET) a USDOT Tier 1 University Transportation Center

Metis Center for Infrastructure and Sustainable Engineering

National Center of Excellence on SMART Innovations

Swette Center for Environmental Biotechnology

Water & Environmental Technology Center (WET)

What's Inside

School of Sustainable Engineering and the Built Environment

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ASU Charter

ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.

Mission

Demonstrate leadership in academic excellence and accessibility

Establish national standing in academic quality and impact of colleges and schools in every field

Establish ASU as a global center for interdisciplinary research, discovery and development by 2020

Enhance our local impact and social embeddedness

Innovative… Inspirational… Ingenious… Inclusive… Impactful

These are the words that come to mind when I think about all that the School of Sustainable Engineering and the Built Environment (SSEBE), and its research and educational programs, accomplished during the past year, one that was undoubtedly unique and challenged us to elevate our enterprise in ways that we had not imagined. With the onset of the COVID-19 pandemic in the middle of the spring 2020 semester, our faculty, staff, and students rapidly pivoted to new modalities in all realms – research, teaching, learning, and professional engagement. When I stepped into the Director role (after shedding the *interim* prefix) in January 2020, little did I know that our enterprise would experience a disruption of such magnitude and uncertainty as that wrought by COVID-19. I am truly grateful for the agility, flexibility, and adaptability demonstrated by our faculty, staff, and students, and for the tremendous support we received from our institutional leadership and many partners, industry advisory boards, and diverse stakeholders. Despite the many challenges that 2020 presented, our students persevered and accomplished their educational and professional goals. Our school graduated more than 400 students ready to pursue careers in construction management and technology and civil, environmental, construction, and sustainable engineering.

The school continues to lead major efforts to advance the engineering of a sustainable future while training the next generation of professionals. To further the important work of the school, we welcomed four new faculty members into our midst – **Ruijie Zeng** and **Mackenzie Boyer** joined us in Spring 2020 and **Thomas Czerniawski** and **Sergio Garcia-Segura** started their tenures in SSEBE in Fall 2020. **Kamil Kaloush** was named the FORTA Professor of Pavement Engineering, thanks to a $1 million investment by the FORTA Corporation. **Rosa Krajmalnik-Brown**, whose groundbreaking work in the relationship between microbiomes (microbes that live in the human body) and human health has led to very promising and potentially transformative treatments for individuals on the autism spectrum, launched a new Biodesign Center for Health Through Microbiomes (BCHTM). **Margaret Garcia** won an NSF CAREER Award to develop new models for water resource management and optimization, **Mikhail Chester** won a $3.5 million NSF Convergence grant to advance urban resilience, **Narayanan Neithalath** won a $2 million NSF AccelNet grant to lead an international network spanning 13 countries for driving innovation in 3D concrete printing, and **David Grau** and **Sam Ariaratnam** won a $1 million NSF Grant for enabling International Research Experiences for Students (IRES). Both NSF Engineering Research Centers (ERC) in which SSEBE faculty play key roles – Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) and Nanotechnology Enabled Water Treatment (NEWT) – were renewed for a second five-year term.

Our faculty are being recognized for their contributions and service. Professor **Edd Gibson** was inducted as a Distinguished Member of ASCE and selected as the first recipient of the Richard L. Tucker Outstanding Service Award by the National Academy of Construction. Professor **Paul Westerhoff** won the American Water Works Association (AWWA) A.P. Black Award for his contributions to water treatment,

Director's Letter

Ram Pendyala

Professor **Kerry Hamilton** was selected to participate in the NAE Frontiers of Engineering Symposium, and Professor **Rebecca Muenich** was named a new face of the American Society of Agricultural and Biological Engineers (ASABE). **Mounir El Asmar** led a school-wide team of faculty, staff, and students to organize and host a very successful ASCE Construction Research Congress at ASU in March 2020, just as the nation was coming to grips with the threat of the contagion. And the list of accomplishments and accolades goes on and on…

Undoubtedly, however, the story of 2020 will be one defined by watershed moments that have tested the nation and the world immeasurably. The toll that the COVID-19 pandemic has exacted on public health and well-being, societal inequities laid bare by systemic racism and discrimination, and the destruction wrought by wildfires and extreme events, have intensified our resolve to advance healthy, prosperous, diverse, inclusive, sustainable, and resilient communities worldwide – in keeping with the mission and goals as outlined in the ASU Charter. SSEBE is fully committed to supporting and advancing the 25 actions that comprise ASU's Commitment to Black Students, Faculty, and Staff, and is embarking on major efforts to recruit, engage and elevate individuals from minority communities in tangible ways. **Marcus Denetdale**, who leads our Construction in Indian Country (CIIC) enterprise, coordinated multiple donation drives at ASU to collect and transport truck-loads of essential goods to tribal nations across the state. The Center for Environmental Health Engineering, led by **Rolf Halden**, has pioneered wastewater-based epidemiology to help detect the presence of COVID-19 in communities. The Center is testing wastewater samples from dozens of cities across the nation to help combat the spread of COVID-19; and **Otakuye Conroy-Ben** has just been awarded a major NIH grant to test wastewater samples for tribal communities, many of which have been excessively affected by the destructive force of the pandemic. Other efforts within SSEBE to address pandemic-induced challenges include **Paul Westerhoff's** work to rapidly disinfect personal protective equipment (PPE) for healthcare workers using germicidal ultraviolet light, **Matt Fraser's** work on the impacts of the pandemic on air quality, **Kristen Parrish's** efforts to help inform the effective deployment of vaccines on a mass scale, and my own work to measure and quantify the impacts of the pandemic on mobility and access to employment – particularly for low income and minority communities.

We may be in the midst of unprecedented times, but our work continues on all fronts and we look forward to growing our impact in the years ahead. We are grateful for your support and welcome opportunities to partner so that we may collectively engage in endeavors that advance our mission and student success. Please connect with us, consider giving opportunities to help support our activities, and let us know how we may of service to you.

Ram M. Pendyala, PhD
Professor and Director
School of Sustainable Engineering and the Built Environment

Civil, Environmental, and Sustainable Engineering (CESE)

Keith D. Hjelmstad, PhD
President's Professor ▪ CESE Program Chair

As one of the largest civil engineering programs in the country we continue to be a leader in the production of outstanding civil engineers as we educate the people who will be responsible for the future of our built environment. A large program has many moving parts. It is always a pleasure to see the students, faculty, staff, and external partners working well together.

This past year has been challenging for everyone, but we are undaunted in our quest to provide the best education possible. The jump to remote learning in the spring of 2020 required everyone to work just a little harder. Faculty had to adapt their teaching overnight and students had to adapt to a new learning environment. We at Arizona State University were lucky to be at an institution better prepared than most to deal with these changes. Every cloud has a silver lining. The dramatic change in learning environment has led to many positive changes in how we think about teaching that will serve us well going forward.

Each year we find new ways to bring significant impact to the world around us. I am confident that the coming year will be another great one!

Construction Engineering (CNE)

Samuel T. Ariaratnam, PhD, PE, PENG, FASCE, FCAE, NAC
Professor ▪ Construction Engineering Programs Chair

This past year has been a challenging one with the global pandemic interrupting our daily lives. All of us had to make a quick adjustment to learning through ASU Sync. I am extremely proud of our students for showing their resiliency and commitment to their education by either attending in-person classes or participating live via Zoom. Fortunately, the construction industry has continued to prosper and our students were able to find excellent employment opportunities for internships and full-time jobs upon graduation this past year.

The Construction Engineering Program continues to attract some of the brightest students who are interested in a degree program that combines both engineering and construction, thereby providing our students with the foundation to both design and manage construction projects. Furthermore, our graduates possess strong analytical and interpersonal skills that are vital for success in today's workplace.

Our program continues to emphasize planning, design, and management for the construction of infrastructure including bridges, airports, pipelines, and other systems that are vital to our nation's economy. Construction Engineering graduates from ASU continue to address domestic and global infrastructure needs to keep up with aging systems and rapidly increasing populations.

I am looking forward to getting back to normal activities and continuing to grow our nationally and internationally-recognized Construction Engineering program. We will continue to maintain a strong educational curriculum, work towards increasing enrollment to meet industry demands, and further cultivate fundraising efforts to support innovative program initiatives. Thank you for all of your support during these trying times!

Environmental Engineering (EVE)

Treavor H. Boyer, PhD
Associate Professor ▪ EVE Programs Chair

The Environmental Engineering (EVE) undergraduate program at Arizona State University is continuing to grow with over 160 students enrolled in the program. The EVE program offers a Bachelor of Science in Engineering (BSE) degree in Environmental Engineering and will seek ABET accreditation during the next ABET visit to the Fulton Schools of Engineering. The mission of the EVE program is to educate tomorrow's engineers to solve complex environmental problems and design systems at the human, urban, and planetary scale. The EVE program includes courses that span introductory concepts, fundamental understanding, and engineering design, and also includes a standalone environmental engineering processes lab course and a required internship or research experience.

The first cohort of students graduated from the EVE program in December 2019 and Spring 2020, and the program has a strong pipeline of graduates for subsequent semesters. A recent development in the program is the addition of Kirk Craig, P.E., Senior Principal, Geosyntec as faculty associate in EVE 452 Fundamentals of Geoenvironmental. Kirk provides considerable experience in environmental site assessment and subsurface remediation, and unique opportunity for students to interact with industry leader.

Finally, like everyone, the EVE program has had to adapt to COVID-19 impacts. For the EVE program that means remote and hybrid teaching including the Environmental Engineering Processes Lab courses. Although challenging, remote and hybrid teaching has provided the opportunity to rethink teaching for the future. I look forward to updating you on the progress and accomplishments of the EVE program in the coming years.

Del E. Webb School of Construction (DEWSC)

Anthony J. Lamanna, PhD, PE, FACI, FASCE
Associate Professor ▪ Del E. Webb School of Construction Programs Chair

The Del E. Webb School of Construction programs are continuing to grow and evolve, even during the pandemic, to meet the needs of our students and industry employers. We had 626 students in construction management in the Fall of 2020!

Our students continue to compete in student competitions and attend national industry events, albeit virtually. If you have an event and would like construction students or faculty to attend, please let us know!

We've successfully restarted our Del E. Webb School of Construction Alumni Chapter; a special thanks to all alumni who helped make that happen. While all events are currently virtual, we look forward to having alumni, students, and faculty networking and mentoring in person. Stay tuned at ***https://www.linkedin.com/showcase/del-e-webb-school-of-construction*** for updates and ways to stay engaged.

We continue to place all our graduates each semester. COVID-19 has posed some hurdles for some of our students with their internships; if your company is able, please consider hiring additional interns. Our two internships are a critical component of educating the future construction leaders of tomorrow.

As we continue to deliver quality education, consider assisting us in recruiting more K-12 students into the construction industry (and to ASU); we can provide brochures, handouts, and branded swag to your employees doing outreach at middle and high schools. More students entering the field mean more students entering our construction programs, which means more graduates entering the workforce.

Graduate Programs

Peter Fox, PhD, PE
Professor ▪ CESE Graduate Program Chair

The School of Sustainable Engineering and the Built Environment graduate degree programs encompass Civil, Environmental and Sustainable Engineering (CESE), Construction Management (CON) and Construction Engineering (Con Eng) - CESE MS, CESE PhD, CON MS, CON PhD and Con Eng MSE and Environmental Engineering MS.

The pandemic has affected all of us but the high quality of our graduate programs continues as reflected by our US News and World Report rankings. This is not only an accomplishment of our current faculty and graduate students, but also the alumni of our graduate programs that have been making an impact on our world.

We continue to have more than 100 PhD students and our PhD student enrollment is growing commensurate with our success at obtaining research centers and our research continues to impact the world around us. We have continued to increase the number of enrolled under-represented groups and our goal to make our program more diverse and inclusive is being embraced by our faculty and research sponsors.

Our new graduate MS degree program in Environmental Engineering started successfully in the Fall of 2020 to complement our growing undergraduate Environmental Engineering (EVE) degree program enrollment. We plan to expand our on-line offerings beyond the Master's Degree Programs in Sustainable Engineering and Construction Management. We are considering offering both full degrees online and certificate programs focusing on current needs and demands. The pandemic has been challenging for all but with crisis, there is opportunity. Our development of on-line courses has been greatly accelerated and will continue into the future.

Construction Management and Technology Graduate Programs

Kristen Parrish, PhD
Associate Professor ▪ Construction Management
Graduate Program Coordinator

The Construction Management and Technology graduate programs continue to grow, in terms of course offerings and enrollment. This growth allows us to serve the needs of the construction industry in Arizona and beyond.

In 2020, we updated our programmatic core to reflect the changing nature of the construction industry. We previously had three core areas, Construction Technology, Project Management, and Project Controls; we now have two core areas, Construction Technology and Project Management & Control. We have also added to our online course offerings, adding courses in Trenchless Technology and Construction Project Management, among others, to meet our students' needs. Moreover, we have continued to diversify the types of applied projects our students complete, ensuring that the culminating experience from our MS program meets our students' needs and helps them develop the skills and competencies required for their careers as construction managers. Finally, we remain committed to the teaching practicum in our PhD program, so our doctoral graduates are able to perform in classrooms, whether it is in the higher education environment, the K-12 environment, or in continuing education.

We continue to recruit students from across the globe into our programs and love to engage our industry partners and alumni in these efforts; please reach out if you are interested in helping to grow the pipeline and pathways for the next-generation of construction managers!

Edd Gibson

Edd Gibson, considered the foremost expert in front-end planning of capital facilities in academia, is one of eight civil engineers nationwide to be named a **Distinguished Member** of the **American Society of Civil Engineers in 2020**. The honor of Distinguished Member, reserved for people who have obtained eminence in engineering fields such as engineering education and construction, recognizes Gibson's career-long contributions in these areas.

He is also an expert in organizational change, asset management, earned value management systems, alternative dispute resolution, safety and prevention through design, and risk management. Over the course of his career, his work has saved the construction industry billions of dollars by improving capital effectiveness.

Gibson served as the SSEBE director from 2010 to 2018.

Margaret Garcia

Thirteen faculty members in the **Ira A. Fulton Schools of Engineering** have received **National Science Foundation Faculty Early Career Development Program (CAREER) Awards**. The awards total an estimated $6.9 million to fund projects over the next five years. Earning the NSF CAREER award is a hallmark achievement for early-career faculty members who have each developed a comprehensive plan to conduct impactful research and deliver a rich educational experience for students.

Assistant Professor **Margaret Garcia** is developing a set of models to help policymakers make informed decisions about water use and infrastructure in regional water supply networks. She plans to examine historical and projected regional water systems and simulate routine water infrastructure operations and adaptive changes to better assess how changes will affect local and systemic resiliency.

Garcia received her PhD in Civil and Environmental Engineering from Tufts University in 2017. Her research investigates the factors influencing the sustainability and resilience of urban water supply systems by advancing the theory of coupled systems, translating theory into actionable models, and applying these models to support infrastructure planning and policy analysis.

Kamil Kaloush

Kamil Kaloush has earned the distinction of being the first **FORTA Professor of Pavement Engineering**, a designation that supplies Kaloush and his lab with $1 million over the next five years to support scholarly activities.

Over the past four decades the FORTA Corporation has built a reputation as a leader in the synthetic reinforcement fibers industry. Through a newly announced professorship at Arizona State University, researchers in the Ira A. Fulton Schools of Engineering will work with FORTA to continue advances to develop stronger pavement materials that make roadways safer and more durable.

Kaloush directs the National Center of Excellence on SMART Innovations at ASU — SMART stands for sustainable materials and renewable technologies. His expertise in pavements and materials has earned him several professional accolades, including the Rubber Pavements Association Outstanding Research Award.

Rosa Krajmalnik-Brown

Rosa Krajmalnik-Brown, Professor and CBBG Senior Investigator has been tapped to lead a new research center at ASU, the **Biodesign Center for Health Through Microbiomes (BCHTM)**. The goal of BCHTM is to engineer the human microbiome to transform human health in a positive way. The Center aims to build on Krajmalnik-Brown's groundbreaking work on the microbiome and metabolism, autism-microbiome, and microbiome interventions to develop a range of interventions involving nutrition, and some of them harnessing the contribution of microbes in gut-brain connections. Knowledge gained will lead to better management of obesity, autism, type 2 diabetes, depression, irritable bowel syndrome, colon cancer and neurodegenerative diseases including Alzheimer's and Parkinson's.

Krajmalnik-Brown is also the recipient of the **Arizona Bioscience Researcher of the Year award**. AZBio is a statewide organization that is dedicated to "building the biosciences industry in Arizona by providing access to key resources, connections and information in our biosciences community."

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JournalAWWA

an official publication of the American Water Works Association

Paul Westerhoff: A.P. Black Award Winner

p. 10

ALSO IN THIS ISSUE

Regents Professor **Paul Westerhoff** was selected to receive the **A.P. Black Award** and his photo appears on the cover of the **Journal American Water Works Association June 2020 Issue**. Normally the recipient delivers a presentation at the June annual AWWA conference, but due to Covid-19 this year he gave a webinar in August 2020. A.P. and Charles Black both dedicated their lives to supplying people with clean, reliable water.

Westerhoff is also the Fulton Chair of Environmental Engineering and the deputy director of the National Science Foundation-sponsored Engineering Research Center for NanoEnabled Water Treatment Technologies known as NEWT. NEWT is developing technologies to provide clean water to millions of people around the world.

American Water Works Association | WILEY

New Faculty Join SSEBE

Thomas Czerniawski

Assistant Professor
PhD, University of Texas at Austin 2020

Joined SSEBE in August 2020

Czerniawski has created computer vision systems for pipe-spool fabrication quality control, building information model updating, and construction progress monitoring. He has also worked on several heavy civil construction projects in transportation and power generation.

As a new assistant professor of construction management Czerniawski will be inspiring students to tackle physical construction challenges with digital tools. Through CON 251: Microcomputer Applications for Construction, students will learn about software tools that are "fundamental to the practice of construction."

The COVID-19 pandemic has raised a greater need for digital technologies on construction sites to facilitate social distancing. Czerniawski plans to take advantage of these new developments to explore the future of remote inspection.

Sergio Garcia-Segura

Assistant Professor
PhD, University of Barcelona, Spain 2014

Joined SSEBE in August 2020

Garcia-Segura was previously an assistant research professor in the NSF Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment (NEWT) lab from August 2017 to 2020.

His research seeks to develop sustainable water treatment technologies by using nano-enabled photo-assisted and electrochemically driven catalytic processes.

He has worked across four continents (Australia, Brazil, Germany, Spain, Taiwan, and USA) in multidisciplinary teams, aiming to ensure availability and sustainable management of water and sanitation for all.

Garcia-Segura's contributions to the field of environmental electrochemistry have been recognized by international awards including the Environmental Electrochemistry Prize of the International Society of Electrochemistry and the Green Talent Award from the German Federal Ministry of Education and Research.

Faculty Honors and Awards

Mikhail Chester: leads $3.5 million NSF Convergence Award to Map the Way to Resilient Cities

Matthew Fraser: professor, appointed SSEBE Associate Director

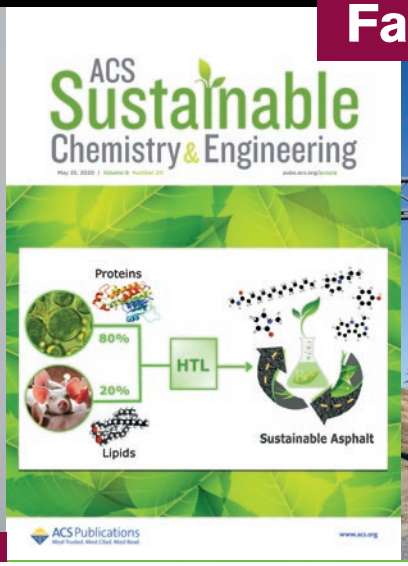
Sergio Garcia-Segura: International Society of Electrochemistry Elsevier Prize

Kerry Hamilton: 2020 NAE Frontiers of Engineering Symposium

Kohinoor Kar, (ADOT): faculty associate, elected to the Transportation Professional Board

Yingyan Lou: Mountain District Outstanding Educator Award from the Institute of Transportation Engineers


Elham (Ellie) Fini



Fini named ASCE Fellow

Elham (Ellie) Fini, associate professor in the School of Sustainable Engineering and the Built Environment, and senior sustainability scientist at Julie Ann Wrigley Global Institute of Sustainability has been named a **Fellow by the ASCE Board of Direction**.

Fini has served as a program director at the National Science Foundation and as president of the American Association of Civil Engineers (Northern branch in North Carolina). She has been Fulbright scholar at Aalborg University of Denmark and research affiliate at MIT's Center for Materials Science and Engineering. She is currently serving as an invention ambassador for American Association for Advancement of Sciences and as the associate editor of ASCE's Journal of Materials in Civil Engineering. She is also the inventor and co-founder of a startup company and has published more than 100 journal papers, one book and one book chapter.

Her achievements were recognized via multiple awards, including the **NSF CAREER award**, the **2017 BEYA STEM Innovation award**, and by nomination for the 2017 BioNight Entrepreneurial Excellence Award.

The WTS NC Triangle Chapter presented **Fini** with their **2020 Innovative Transportation Solution Award** at the 2020 WTS Go Gala on August 20th. This award salutes an innovative transportation project led by a woman.

The mission of WTS International is to attract, sustain, connect and advance women's careers to strengthen the transportation industry.

Fini's research and patent-pending technology was featured on the **cover page of ACS Sustainable Chemistry & Engineering journal**.

François Perreault: Quentin Mees Research Award; selected to attend the Seventh Arab-American Frontiers of Science, Engineering, and Medicine Symposium

Paul Westerhoff: closing the Water Access Gap through $3.5M NSF Convergence Award; among 2020 Web of Science Highly Cited Researchers

BEST ONLINE PROGRAMS
U.S.News & WORLD REPORT
RANKINGS

#5 Civil engineering
best online master's program

Rosa Krajmalnik-Brown: Among 2020 Web of Science Highly Cited Researchers


Rebecca Muenich

Honoring young talent in the profession

New Faces of ASABE (American Society of Agricultural and Biological Engineers) recognizes the outstanding talents and passions of the rising generation of engineering leaders, whose work is already having significant impact on lives and livelihoods around the globe.

Rebecca Muenich, assistant professor of environmental engineering was named a **New Face of ASABE** in 2020.

She joined Arizona State University as an assistant professor in the School of Sustainable Engineering and the Built Environment in the fall of 2017, where her research focus has been on applying and advancing environmental modeling and analysis methods to evaluate trade-offs and identify solutions at the food-energy-water nexus.

She was also a recipient of the American Society of Biological and Agricultural Engineering's Robert E. Stewart Engineering and Humanities Award in 2011.


Edd Gibson

First recipient of the Richard L. Tucker Outstanding Service Award

The **National Academy of Construction (NAC)** has announced **Edd Gibson**, professor and Sunstate Chair in Construction Management and Engineering as the first recipient of the **Richard L. Tucker Outstanding Service Award**.

NAC established the award in 2020 to honor an individual whose support of NAC over a sustained period-of-time has enabled NAC to grow and prosper. The Academy chose to name the award in honor of Richard L. Tucker, its founder. He personally led the establishment of NAC in 1999 as a way to recognize those in the engineering, design, and construction industries who have made significant contributions over a career.

Gibson was selected based on his contributions to the Academy over the past 15 years. He was inducted in 2005 for "significant contributions in pre-project planning, risk assessment, and dispute avoidance and resolution, and research and continuing education." Since then, he has served as the co-chair and principal author of the NAC National Construction Forum, which eventually resulted in the Academy's Executive Insight essays. He helped organize the NAC summit at ASU with the National Association of Public Administrators.

New ASU research center promotes inclusive STEM education

The **Research for Inclusive STEM Education Center**, a newly launched Arizona State University initiative, is striving to make higher education more inclusive through innovative research, ongoing events and campus-wide interventions.

The center was founded by **Sara Brownell**, associate professor in the School of Life Sciences and **director** of the center, and **Kristen Parrish**, associate professor in the School of Sustainable Engineering and the Built Environment and **associate director** of the center.

The center has several goals including identifying inequities that are currently in classrooms across the university and implementing solutions, conducting and producing innovative research on ways to make undergraduate STEM classrooms more inclusive, and educating and informing STEM faculty about this research and how they can better serve all students. Their work is meant to not only improve inclusivity within the ASU community, but also inspire change at institutions.

Kristen Parrish

Pollution Prevention Grant received from the EPA

The U.S. Environmental Protection Agency (EPA) has awarded $9.3 million in **pollution prevention grants** to 42 organizations across the nation. One of them was awarded to Arizona State University.

The School of Sustainable Engineering and the Built Environment was given more than $376,000 to continue their water efficiency project that began in 2018.

Assistant research professor **Mackenzie Boyer** leads the project. She says when a company wants to switch out one flavored product for another, for example, the question is: How much water is needed to efficiently and effectively wash out the tank. She and others have developed sensors to detect those flavor signatures and see how they change as tanks are cleaned.

Mackenzie Boyer

2020 Scholarships and Fellowships

Thomas Alexander
Tom & JoAnn Prescott New American University Scholarship

Shalee Allison
Construction in Indian Country Native American Scholarship

Mohammed Alnahari
FSE Undergraduate Emergency Fund Application

Ashraf Alrajhi
Dr. Matthew W. Witczak Scholarship

Jake Amicarelli
Del E. Webb School of Construction Scholarship

Akshay Kumar Anand
Fulton Schools of Engineering Emergency Fund GRADUATE Scholarship

Cleo Andaya
Andrew Hanneman Scholarship

Katherine Anderson
Suntec Concrete Scholarship

Stettler Anderson
AGC Construction ASU Student Scholarship; PENTA Building Group Scholarship

Edward Apraku
Jan Tuma Memorial Scholarship

Michael Austin
AGC Construction ASU Student Scholarship

Michael Ballenger
Frank M. Chandler Memorial Scholarship

Logan Bashford
The Beavers Heavy Construction Scholarship

Bryan Berry
Terry Bourland Memorial NAMU Scholarship

Carter Bode
Robert H. Johnson Undergraduate Scholarship

Solomon Brooks
Jan Bennett Endowed Scholarship

Julian Cervantes
Associated Minority Contractors Association NAMU Scholarship

Olivia Chapin
Terry Bourland Memorial NAMU Scholarship

Lawrence Chapman
AGC Construction ASU Student Scholarship

Heidi Chretien
Edd & Gail Gibson M&G Leaders Scholarship; Ben C. Griggs Memorial Scholarship

Michael Cisek
Charles & Nancy O'Bannon Scholarship for Construction

Austen Cowper
Andrew Hanneman Scholarship

Sara Curry
Girl Scouts of America Scholarship; Martin H. Rosness Memorial Scholarship

Farshid Damirchilo
Del E Webb Foundation Graduate Scholarship

Coral Dober
Marvin Sheldon Memorial Scholarship

Ryan Downes
Eric and Kristina Scholarship

Ledg Downs
Samuel F. Kitchell Undergraduate Leadership Award

Aletta Oswald Dsouza
Betty Hum Graduate Assistantship; Fulton Schools of Engineering Emergency Fund GRADUATE Scholarship

Uriel Duncan
Construction in Indian Country Native American Scholarship

William Ellison
Construction in Indian Country Native American Scholarship

Connor Elmasry
D.L. Withers Construction Scholarship

Panneerselvam Errappa Kanniappan
Del E Webb Foundation Graduate Scholarship

Victor Evans
FNF Construction Inc. Scholarship; John Lamberson Memorial Scholarship

Aaron Fairchild
FSE Undergraduate Emergency Fund Application

Micah Franzel
PENTA Building Group Scholarship

Julio Galaviz
Dr. Sandra L. Weber Memorial Scholarship

Dawson Gardiner
CRSI Education and Research Foundation

Rafael Gomez-Alonso
Team DSC Scholarship for Excellence in Craftsmanship

Austin Gooch
Jim Bebout Scholarship

Ryan Grey
Construction in Indian Country Native American Scholarship

Audelo Gutierrez
Briston Veteran Advancement Scholarship

Summer Gutierrez
Advancing Women in Construction Scholarship

James Haden
FNF Construction, Inc. Scholarship

Dylan Haftings
Carl L. and Jean Wolcott Meng Memorial Scholarship

Trent Hamamoto
The Beavers Heavy Construction Scholarship

Jeremiah Harris
R. Glen Schoeffler Scholarship

Robert Heaton
D.E.Tommaso Endowment (NAMU): Dave Clifton Memorial and ASPE Chapter 6 Scholarship

Jacob Hedeen
The Beavers Heavy Construction Scholarship

Alysha Helmrich
Harold & Lucille Dunn Memorial Engineering Scholarship

Katrina Hinsberg
Richard E Mettler Residential Fellowship; Ferdinand A. Stanchi Fellowship

Jared Hogie
Pulte Home Corporation Scholarship

Thomas Holt
Robert J. Wheeler Memorial Scholarship

Aaron Huerta
AMCA NAMU Scholarship; The Beavers Heavy Construction Scholarship

Camila Ibarra
Structural Engineers Assoc. of Arizona Scholarship

Alexander Jablon
Del E. Webb Memorial Scholarship

Dakota Jensen
Construction in Indian Country Native American Scholarship

Robsan Jigayo
Del E. Webb Foundation Undergraduate Student Scholarship

Christian Jimmie
Rod J. McMullin SRP Water Resource Scholarship

Thomas Johnson
Samuel F. Kitchell Undergraduate Leadership Award

Mandar Joshi
Fulton Schools of Engineering Emergency Fund GRADUATE Scholarship

Mason Knape
A.G.C. Construction ASU Student Scholarship

Spencer Kolesar
John G. Colton Construction Study Fund; James Grose New American University Scholarship (NAMU)

Jacob Kopitske
Jason McElroy Memorial Scholarship

Jett Larson
The Beavers Heavy Construction Scholarship

Ryan Laverdiere
Dave Clifton Memorial and ASPE Chapter 6 Scholarship

Mecah Levy
Robert J. Wheeler Memorial Scholarship

Stephanie Lies
PENTA Building Group Scholarship

Arely Lopez Cortez
Daniel and Katherine Mardian Scholarship

2020 Scholarships and Fellowships

Cesar Lopez-Rodriguez
Robert J. Wheeler Memorial Scholarship

Jillian Lopker
Tempe Union High School District Scholarship

Marisol Magana
Robert H. Johnson Undergraduate Scholarship

Brian Mangan
Del E. Webb School of Construction Scholarship (CEAS)

Paul Mathews
Richard E Mettler Residential Fellowship

Cole Maurer
IAFSE Alumni Continuing Student Scholarship; Blowers Engineering Scholarship

Colin McCaughey
Stephen and Therese Pisarcik Scholarship; Del E. Webb School of Construction Scholarship (CEAS)

Marilyn Mendoza
Westwood Scholars

Peter Metallo
Robert H. Johnson Undergraduate Scholarship

Jonathan Montero
Jason McElroy Memorial Scholarship

Alejandro Munoz
Dr. Matthew W. Witczak Scholarship

Amber Nguyen
Jerry King Scholarship

Anthony Ocrant
The Beavers Heavy Construction Scholarship

Giovanni Orlando
Ben C. Griggs Memorial Scholarship

Joel Ortiz
The Beavers Heavy Construction Scholarship

Cameron Ott
Opus West Construction Corporation Undergraduate Scholarship

Conner Ottinger
Suntec Concrete Scholarship

William Owens
John G. Colton Construction Study Fund

Zachary Palmer
Frank M. Chandler Memorial Scholarship

Miguel Perez
FSE Undergraduate Emergency Fund Application

Kevin Perreault
A.G.C. Construction ASU Student Scholarship; Terry Bourland Memorial NAMU Scholarship

Courtney Pifer
CEMEX Scholarship for Advancing Women in Construction

Helen Platt
Daniel and Katherine Mardian Scholarship

Kristin Pond
James Fann Memorial Scholarship

Joseph Priorello
Del E. Webb Memorial Scholarship

Alia Raderstorf
Charles and Nancy O'Bannon Scholarship - Civil

Md Nafiur Rahman
Dr. Matthew W. Witczak Scholarship

Rahul Rai
Fulton Schools of Engineering Emergency Fund GRADUATE Scholarship

Kiarash Ranjbari
Phoenix/Scottsdale Groundwater Contamination Scholarship for Environmental Science

Wyatt Reinke
FSE Undergraduate Emergency Fund Application

Jeremy Revels
Del E. Webb Memorial Scholarship; Construction in Indian Country Native American Scholarship

Kellen Rhoads
Suntec Concrete Scholarship

Cain Ridgeway
Del E. Webb School of Construction Scholarship (CEAS)

Adrian Robak
Tempe Union High School District Scholarship

Crystian Rodriguea
Tempe Union High School District Scholarship

Beverly Rondan Rosas
Del E. Webb Foundation Finance and Accounting Scholarship

Maxwell Ruhnke
Del E. Webb Foundation Undergraduate Student Scholarship

Derek Salas
Robert H. Johnson Undergraduate Scholarship

Arturo Salgado
Del E. Webb Foundation Finance and Accounting Scholarship

Meyah Sanchez
Associated Minority Contractors Association (AMCA) NAMU Scholarship; CFMA Joseph J. Quigley Memorial Scholarship

Karl Schranz
Del E. Webb School of Construction Scholarship (CEAS)

Isaac Sheppard
William A. Pulice Scholarship Endowment

Garrett Smith
James Grose New American University Scholarship (NAMU); CFMA Joseph J. Quigley Memorial Scholarship

Sophia Smith
Del E. Webb School of Construction Scholarship (CEAS)

Joseph Speakman
Del E. Webb Memorial Scholarship

Tanner Spohn
James Fann Memorial Scholarship

Jacob Sullivan
Jan Bennett Endowed Scholarship

Alexander Terberg
A.G.C. Construction ASU Student Scholarship

Joshua Thomas
DeTommaso Endowment (NAMU); Del E. Webb Foundation Finance and Accounting Scholarship

Quang Tran
Opus West Construction Corporation Undergraduate Scholarship

Maggie Tsosie
Construction in Indian Country Native American Scholarship

Luis Gerardo Ventura Villagrana
Del E Webb Foundation Graduate Fellowship

Lizeth Villanueva
Advancing Women in Construction (AWIC) Scholarship

Matthew Vitucci
Paragon Structural Design Inc. Scholarship

Brian Volker
LC Jacobson Graduate Fellowship; Harold & Lucille Dunn Memorial Engineering Scholarship

Benjamin Warren
Robert J. Wheeler Memorial Scholarship

Parker Webber
Suntec Concrete Scholarship

Jack Whitley
Stantec Scholarship

Sydney Wickman
Elyse and Paul Johnson Maroon & Gold Leaders Scholarship (NAMU)

Treavor Williams
Desert Star Construction Excellence in Luxury Home Building Scholarship

Brenna Windish
Del E. Webb Foundation Women in Construction Scholarship

Tyler Yonker
Ron Pratte Scholarship

Julia Zimmerman
Tom and JoAnn Prescott New American University Scholarship

Sarah Zinke
AzSCE Scholarship; Amy Geiser and Kent Geiser Honorary Scholarship

Ronaldo Zuniga Hernandez
Del E. Webb Foundation Undergraduate Student Scholarship

Doctoral Graduates in 2020

Khaled Aldossari
Organizational Change Management for the Adoption of Alternative Project Delivery Methods within the AEC Industry
Chair: Kenneth Sullivan

Hani Selmi Alharbi
Stabilization of Expansive Soil Using Plant-Extracted Silicate Solution
Chair: Claudia Zapata

Megan Altizer
Enhancing Reductive Dechlorination through Electrokinetic Transport and Microbially Driven H2 Cycling in the Subsurface
Chair: César Torres and Rosa Krajmalnik-Brown

Habib Azarabadi
Techno-Economic Analysis of Capturing Carbon Dioxide from the Air: Positioning the Technology in the Energy Infrastructure of the Future
Chair: Klaus Lackner

Baloka Belezamo
Data-driven Methods for Characterizing Transportation System Performances under Congested Conditions: A Phoenix Study
Chair: Xuesong Zhou

Jaiwei Chen
Context Integration for Reliable Anomaly Detection from Imagery Data for Supporting Civil Infrastructure Operation and Maintenance
Chair: Pingbo Tang

Yutian Chen
The Identification of a Potential Solution to Improve the Construction Project Performance in the Chinese Construction Industry: by Analyzing Similar Construction Industries in Other Developing Countries
Chair: Oswald Chong

Namho Cho
Using Industry Data to Make an Impact on Construction Practices over the Project Lifecycle
Chair: Mounir El Asmar

Jeffrey Feghaly
Innovative Delivery of Water Infrastructure Projects
Chair: Mounir El Asmar

Amr Fenais
Developing an Augmented Reality Solution for Mapping Underground Infrastructure
Chair: Samuel Ariaratnam

Emily Ford
Experimental Investigations and Machine Learning-Based Predictive Modeling of the Chemo-mechanical Characteristics of Ultra-High Performance Binders
Chair: Narayanan Neithalath

Brandon Gorman
Contingency Analysis for Coupled Power-Water Networks
Chair: Nathan Johnson

Steven Hart
Anaerobic Digestion Kinetics of Batch Methanogenic and Electrogenic Systems
Chair: César Torres

Sichuan Huang
Self-Burrowing Robot Inspired by Nature
Chair: Junliang Tao

Sk Faisal Kabir
Surface Activation of Rubber to Enhance the Durability and Chemo-Mechanics of Asphalt
Chair: Elham Fini

Justin Kidd
Environmental, Human Health, and Societal Impacts of Nanosilver and Ionic Silver Used in Industrial and Consumer Products
Chair: Paul Westerhoff

Mariana Lopes
Visible and Ultraviolet Light Side-Emitting Optical Fibers Enable Water Purification
Chair: Paul Westerhoff

Shyamsunder Loukham
Failure Modeling in an Orthotropic Plastic Material Model under Static and Impact Loading
Chair: Subramaniam Rajan

Evvan Morton
Reframing the Climate Change Problem: Evaluating the Political, Technological, and Ethical Management of Carbon Dioxide Emissions in the United States
Chair: Klaus Lackner

Anjali Mulchandani
Thermally Driven Technologies for Atmospheric Water Capture to Provide Decentralized Drinking Water
Chair: Paul Westerhoff

Thuy Nguyen
De Facto Reuse Impacts on Drinking Water Quality at Small Public Water Systems
Chair: Paul Westerhoff

Hossein Noorvand
Advancing Knowledge of Mechanically-Fiber Reinforced Asphalt Concrete
Chair: Kamil Kaloush

Daniel Oldham
Implications of Bio-modification on Moisture Damage Mechanisms in Asphalt Binder Matrix
Chair: Elham Fini

Amirul Islam Rajib
Structure-Property Relationships to Understand Comprehensive Rejuvenation Mechanisms of Aged Asphalt Binder
Chair: Elham Fini

Hannah Ray
Nitrogen recovery from human urine by membrane processes
Chair: Treavor Boyer

Naman Saklani
Implementation of a Coupled Creep Damage Model in MOOSE Finite Element Framework: Application to Irradiated Concrete Structures
Chair: Narayanan Neithalath

Alireza Samieadel
Multi-scale characterization of bitumen doped with sustainable modifiers
Chair: Elham Fini

Rachael Sherman
Assessing the Impact of Regulation on the Performance of Power and Pipeline Projects
Chair: Kristen Parrish

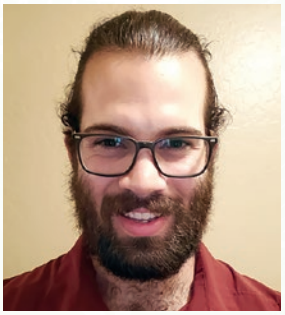
Zhe Sun
Predictive Control of Interpersonal Communication Processes in Civil Infrastructure Systems Operations
Chair: Pingbo Tang

Neda Askari Tari
Application of Phase Change Materials for Building Energy Retrofits in a Hot Arid Climate
Chair: Kristen Parrish

Student Recognition


Stettler Anderson


Dylan Haftings

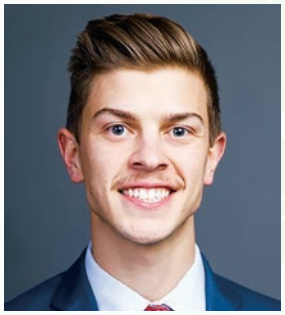

Ryan Laverdiere


Brooke Logan


Macy Canete


Ashley Colaizzi


Brielle Januszewski


Kyle Reep

Spring 2020

Outstanding Senior Award

Macy Canete
Ashley Colaizzi
Brielle Januszewski
J. Kyle Reep

Leadership and Service Award

Alexander Castro
Kendra Johnson
Cole Maurer
Amanda Minutello
Valentino Nunez
Austin Schranz
Adam Tran

4.0 Award

John Patrick Beltran
David Goras
Brielle Januszewski
Juan Martinez
Cole Maurer
Jessica Miranda Molina
Misael Perez Saldivar
Sarah Zinke

Engineer-In-Training Certification

Morgan Alkahlout
John Patrick Beltran
Corbin Bendel
Casey Blue
Allyson Camillucci
Erik Cesek
Joseph Conner
Kristina Coppinger
Cody Couch
William Grgantov
Shaela Hogue
Kendra Johnson
Jared Kahler
Lindsay Lee
Jeremiah Loveall
Cole Maurer
Saif Mohammed
Grant Purdy
Marielle Ransom
Kendall Rees
Dylan Renner
Brian Roman
Justin Steinberg
Kristen Stevens
Brandi Tamura
Adam Tran
Jesse Vasquez
Esli Vega
Teagun Wolf
Sarah Zinke

Construction Professional Certification

Andrew Gorman

Summer 2020

Engineer-In-Training Certification

Zackery Babbitt
Marie Bear
Alan Holladay
Ken Niimi

Fall 2020

Outstanding Senior Award

Stettler Anderson
Dylan Haftings
Ryan Laverdiere
Brooke Logan

Leadership and Service Award

Marisol Magana
Jeremy Revels
Derek Salas

4.0 Award

Jeremy Revels
Joseph Speakman

Engineer-In-Training Certification

David Burke
Taylor Ford
Smust Nipitkulton
Preyesha Tapiawala

Undergraduate Research

Emma Bonham

SSEBE students conduct research through Fulton Undergraduate Research Initiative (FURI)

The Fulton Undergraduate Research Initiative (FURI) is designed to enhance the engineering and technical undergraduate curriculum by providing hands-on lab experience and independent and thesis-based research.

Students conducting research through FURI spend a semester conceptualizing an idea, developing a plan and investigating their research question. Through this work, they are developing innovative solutions to real-world challenges in data, education, energy, health, security and sustainability.

Many FURI students have gone on to apply their unique experience to work in industry, as well as graduate studies in engineering, medicine, law and other disciplines.

We are proud and excited to share their work with you.

Edward Apraku (Fall 2020)
Concrete Canoe Fabrication and Competition
Mentor: Kristen Ward

Emma Bonham (Fall 2020)
Assessing Urban Agricultural Practices in the Desert Cities
Mentor: Rebecca Muenich

Tannis Breure (Spring 2020)
Biochar's Ability to Remove Escherichia Coli
Mentor: Rebecca Muenich

Lucas Christopher Crane (Fall 2020)
Enzyme induced carbonate precipitation using fresh urine and calcium-rich zeolites
Mentor: Treavor Boyer

Ebenezer Duah (Summer 2020)
Three-Dimensional Fracture Analysis of Viscoelastic Pavement Materials Using the Generalized Finite Element Method
Mentor: Hasan Ozer

Camila Ibarra (Spring 2020)
American Society of Civil Engineering
Mentor: Kristen Ward

Daniel Katusele (Fall 2020)
Virtual Testing to Determine the Behavior of Orthotropic Materials
Mentor: Subramaniam Rajan

Kiarash Ranjbard (Fall 2020)
Non-Toxic Nucleation and Passivation of Silver Nanoparticles on Stainless Steel for Biofouling Control
Mentor: François Perreault

Jing Wen Soh (Fall 2020)
Solar Membrane Desalination
Mentor: François Perreault

Marcela Strane (Fall 2020)
Silver Analysis on Stainless Steel 316 Coated Aluminum Oxide Used for Water Systems on Spacecrafts
Mentor: François Perreault

Kaley Yazzie (Fall 2020)
Atmospheric Water Capture and the Effects on Organic Matter
Mentor: Paul Westerhoff

furi.engineering.asu.edu

Student Honors and Awards

The **Best Poster Award of the 2020 ASCE Construction Research Congress** was given to the conference paper "*Automated Extraction of Overhead Power Conductors and Vegetation Clearance Volumes with Morphology Reasoning and Geometric Inference,*" which is a result of the SPR+ASU Joint Research Program.

Awardees are **Tiyasa Ray** (PhD candidate), **Bala Paladugu** (PhD candidate) and professor David Grau.

Ebenezer Duah, a master's student in civil engineering, is a recipient of the annual **Graduate Research Award** from the **Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP)**. His paper is titled *"Critical Distresses Analytics to Develop Performance Prediction Models for Small Hub Airfield Pavements."* Hasan Ozer is his faculty mentor.

The ACRP Graduate Research Award offers a $12,000 stipend as well as the opportunity for the student's final research paper to be published in TRB's journal, *Transportation Research Record* (TRR), and to present their work at TRB's Annual Meeting, to be held virtually in January 2021.

PhD student **Naushita Sharma** received the $10,000 **Holly A. Cornell Scholarship** from the American Water Works Association (AWWA), an organization dedicated to improving water quality and supply. Created in 1990 and sponsored by Jacobs/CH2M the scholarship honors co-founder Holly A. Cornell to encourage and support outstanding female and/or minority students pursuing advanced training in the field of water supply and treatment. Sharma is a civil, environmental and sustainable engineering doctoral student working with Professor Paul Westerhoff.

SSEBE students win the **AZITE Traffic Bowl** at the 2020 Arizona Section of the Institute of Transportation Engineers AZITE-IMSA Spring Conference.

Denise Capasso da Silva wins **2020 Jenny L. Grote Student Leadership Award** from the Arizona Section of the Institute of Transportation Engineers (AZITE).

The winner of the **11th Annual Geosyntec Student Paper Competition** is **Aide Robles**, Advisor: Dr. Anca Delgado for the paper titled *"Microbial Chain Elongation Drives Complete Reductive Dechlorination of Trichloroethene."* Aide received a cash prize of $1,000.

Advancing Our Students

Professor Samuel Ariaratnam (left) and Associate Professor David Grau (right) pose with biological design doctoral student Ashley Heida near a construction site close to Arizona State University's Tempe campus. Heida is one of the first students to be accepted into an international research program administered by Ariaratnam and Grau. She will work with researchers at Stellenbosch University in South Africa to develop solutions to water scarcity.

ASU partnering with universities in seven countries to provide international research experiences to U.S. graduate students

Associate Professor **David Grau** and Professor **Samuel Ariaratnam** were awarded $1 million by the NSF to direct the project entitled **International Research Experiences in Civil, Construction and Environmental Engineering**.

With that award, program principal investigator Grau and co-principal investigator Ariaratnam plan to send as many as 75 students during the next three years to do research or otherwise immerse themselves in learning experiences under the guidance of top faculty members at one of seven leading universities around the world.

The partner universities are Tsinghua University in China, the University of Alberta in Canada, Stellenbosch University in South Africa, Ben Gurion University of the Negev in Israel, the Indian Institute of Technology – Madras in India, Universidad EAFIT (originally the Escuela de Administración, Finanzas e Instituto Tecnológico) in Colombia and the University of New South Wales in Australia.

In addition to a first-hand look at how engineering is done in different countries, Grau and Ariaratnam say the quality of education and research at those seven universities will offer students working environments conducive to developing global networks of collaboration that can have significant career-enhancing value.

SSEBE students **Marion Bellier** and **Brielle Januszewski** win prestigious **NSF Graduate Research Fellowships**.

For students who are passionate about research and advanced scientific study, the NSF GRFP is the pinnacle of opportunities. The NSF GRFP fellows are seen as budding experts who "can contribute significantly to research, teaching and innovations in science and engineering." The five-year fellowship program funds graduate students with a three-year stipend of $34,000 plus a $12,000 allowance for education costs.

Environmental Professions of Arizona (EPAZ) awards their 2020 scholarship of $2,000 to PhD student **Juliana Levi** from the Westerhoff group. The scholarship comes with cash awards aimed to recognize excellence in research. Juliana Levi is part of the NSF Nanosystems ERC for nanotechnology enabled water treatment (NEWT).

A farmer drives a tractor in Sonora, Mexico.

Mexico-US binational award to research sustainable agriculture in Sonora, Arizona

A new collaborative effort between Arizona State University and the Instituto Tecnológico de Sonora (ITSON) will allow graduate students to participate in a hands-on, cross-cultural program focused on sustainable agriculture in the desert landscapes of North America.

The **U.S.-Mexico Training in Environment, Agriculture and Management (TEAM)** program aims to teach graduate students about the agricultural practices, environmental assessments and sustainable management tools used by different agricultural regions in a similar climate.

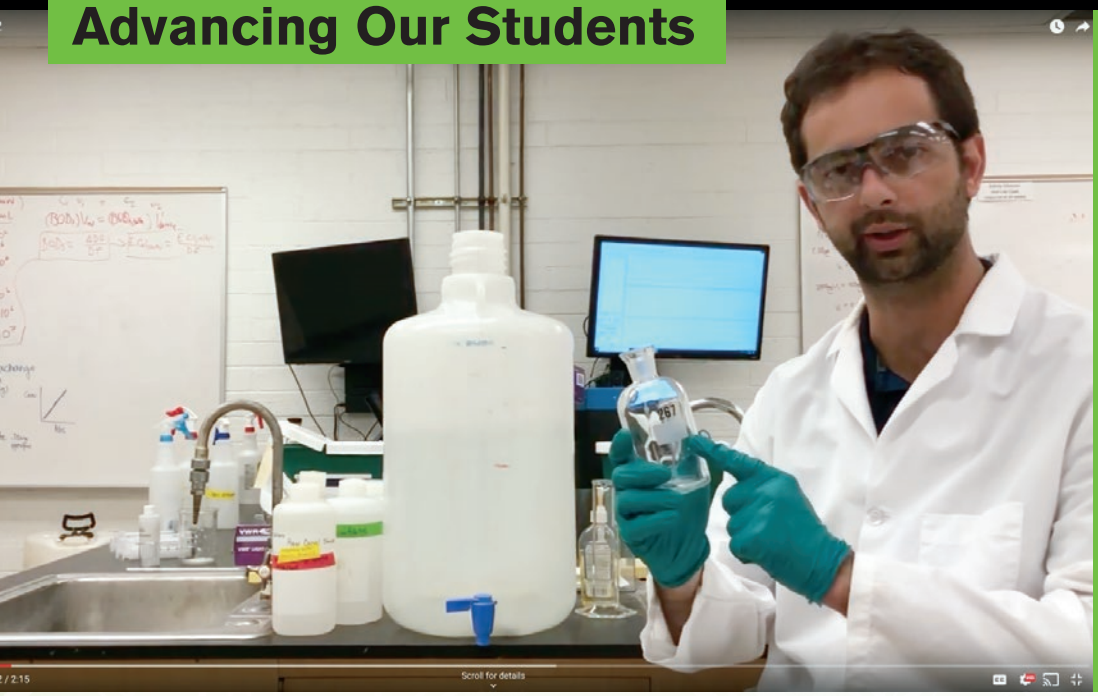
Specifically, students will examine the agricultural landscapes of the Maricopa and Pinal counties in central Arizona and the Yaqui Valley in southern Sonora, Mexico and conduct a comparative study to assess the capabilities of sustainable farming in each region.

TEAM is the result of a 100,000 Strong in the Americas Innovation Award, the U.S. Department of State's signature hemispheric-wide initiative to champion the power of education to transform societies, provide opportunity and stimulate economic prosperity.

Enrique Vivoni

"Graduate students from ASU and ITSON will be in a unique position to interact through formal coursework facilitated through technology as well as hands-on, practical field experience garnered through visits to agricultural systems of different types in Arizona and Sonora," said **Enrique Vivoni**, professor in the School of Sustainable Engineering and the Built Environment and School of Earth and Space Exploration and associate dean of graduate initiatives in the Graduate College and ASU's principal investigator for the program.

Advancing Our Students



In the wake of the COVID-19 pandemic, Arizona State University transitioned all in-person classes, advising and other services and activities online. Faculty and staff have found engaging and effective ways to carry on these activities remotely.

Teaching assistant Thiago Barbosa demonstrates a biochemical oxygen demand lab experiment for Lecturer Mackenzie Boyer's course, CEE 361: Introduction to Environmental Engineering. Videos bring the lab to students who are attending classes online from home. Image courtesy of Thiago Barbosa

Students, faculty and staff find success in a new digital environment

Coming back from spring break, students were faced with adjusting to a new normal. In the wake of the **COVID-19** pandemic and the need for social distancing, ASU transitioned all in-person classes, advising and other student services, and community-focused activities to online delivery.

As disruptive as the change may have been to typical routines, students, faculty and staff members sprang into action — trying new things, finding solutions and adapting to a new mode of learning.

The transition to distance learning likely has some students missing the daily interaction with their peers, faculty and other university staff. However, the online video conferencing tool Zoom helps bring facetime to digital classes, while the instant messaging platform Slack encourages conversation within the ASU community. Nontraditional tools like the livestreaming platform Twitch have even helped some instructors keep their classes engaging.

On the first day of online course delivery, more than 15,000 ASU classes were taught on Zoom and 55,000 students logged in to attend their now-online courses. The numbers have been growing since they launched on March 16, with the Fulton Schools' more than 24,000 students adding to that number.

When students always have a front-row seat to the presentation and interruptions common in large classrooms can be minimized, instructors can get their lessons across more efficiently.

Keith Hjelmstad

"I think most faculty are taking this as a problem to be solved, which is something we do pretty well," **said Keith Hjelmstad, President's Professor and CESE Program Chair.** ***"In talking to my colleagues, I am quite impressed by the creative ideas that are popping up all over the place."***

Many buildings around the country are closed indefinitely to prevent the spread of COVID-19, but water left sitting in pipes could change in quality. The Arizona heat could exacerbate stagnation problems.

Research shows water quality could diminish in closed buildings during COVID-19 pandemic

ASU researcher joins study to understand how extended shutdowns affect water quality in buildings

A serious health risk may be growing in water inside pipes in buildings that have been closed as businesses were shut down because of the COVID-19 pandemic — especially restaurants, bars and gyms. Disease-causing microorganisms could be breeding in such stagnant water, says **Kerry Hamilton**, assistant professor who does research in the Center for Environmental Health Engineering. Hamilton has coauthored a report with colleagues at Purdue University, a project funded by the National Science Foundation, to address challenges assessing water conditions in buildings that have been vacant for long periods and recommending best practices to restore water quality.

It's possible that water left sitting for long periods of time could contain excessive amounts of heavy metals and pathogens concentrated in pipes nationwide, say researchers who have begun a field study on the impact of a pandemic shutdown on buildings.

Typically, buildings can prevent stagnation through regular water use. This brings in new water with disinfectant. But extended building shutdowns will require different solutions, the researchers said. The Centers for Disease Control provides guidelines for the reopening of buildings after shutdowns.

Kerry Hamilton

"There are several factors that encourage the growth of disease-causing microorganisms in buildings — low or nonexistent disinfectant residual, such as chloramine or chlorine, poor temperature control and water stagnation inside water pipes," **said Hamilton. Hamilton has expertise in risk assessment for pathogenic microorganisms, specifically for the bacteria that causes Legionnaires' disease commonly linked to poor water quality in buildings.**

Novel coronavirus detected, monitored in wastewater

Within weeks of arriving on the world stage, SARS-CoV-2 has managed to encircle the globe, leaving illness, mortality and economic devastation in its wake. One of the central challenges facing health authorities and the medical community has been testing for the elusive virus on a sufficiently comprehensive scale.

A new approach to monitoring the novel coronavirus (as well as other dangerous pathogens and chemical agents) is being developed and refined. Known as **wastewater-based epidemiology (WBE)**, the method mines sewage samples for vital clues about human health. It can potentially identify levels of coronavirus infection at both a local and global scale.

Ultimately, WBE holds the promise of near real-time monitoring of disease outbreaks, resistant microbes, levels of drug use or health indicators of diabetes, obesity and other maladies.

In a new study, ASU researchers Professor **Rolf Halden** and PhD student **Olga Hart** analyze what can and cannot be measured when tracking SARS-CoV-2 in wastewater, and they highlight the economic advantages of the new approach over conventional disease testing and epidemiological surveillance.

"Our results show that exclusive reliance on testing of individuals is too slow, cost-prohibitive and in most places, impractical, given our current testing capacity," Halden said. "However, when preceded by population-wide screening of wastewater, the task becomes less daunting and more manageable."

Professor Rolf Halden meets in his lab at the Center for Environmental Health Engineering at ASU's Biodesign Institute with Assistant Research Scientist Erin Driver (at left) and civil, environmental and sustainable engineering graduate student Nivedita Biyani (at right).

Currently, the U.S. features the largest national and international WBE network and sample repository, known as the **Human Health Observatory (HHO)** at ASU. Recently, SARS-CoV-2 was added to a range of health indicators subject to continuous tracking by the HHO since May 2008.

Halden's technique boasts high sensitivity, with the potential to detect the signature of a single infected individual among 100 to 2 million persons.

In addition to reducing transmission and fatality resulting from SARS-CoV-2 infection, improved population wide data provides other societal benefits. By pinpointing viral hot spots, researchers will be able to better direct resources to protect vulnerable populations through social distancing measures, while easing restrictions in virus-free regions, minimizing economic and social disruption.

Valley company receives federal contract for COVID-19 wastewater study

AquaVitas, a company spun off from research in ASU's Biodesign Center for Environmental Health Engineering, directed by Professor **Rolf Halden** has been awarded a U.S. Department of Health and Human Services contract to test water treatment plants across the country for signs of COVID-19. Halden and his team have developed wastewater analytics over the past several years that enable assessment of COVID-19 trends in communities. Data collected by Aquavitas will provide municipalities information that can be used to guide public health decisions in responding to COVID-19 outbreaks.

ASU Professor Narayanan Neithalath and four colleagues have been granted $2 million from the National Science Foundation to foster collaboration around 3D concrete printing research across more than a dozen countries. 3D concrete printing generated these examples shown with Sooraj Nair, a doctoral student in Neithalath's lab group. The technique offers the potential to change the nature of construction.

Neithalath awarded $2 million to recast concrete construction

Construction is a traditional industry. Fundamental work is performed in much the same way it has been for generations.

Consider the creation of concrete. Crews build a formwork or frame on-site. Cement and other materials are measured and mixed. Then the concrete is poured, compacted and cured or hardened over several weeks.

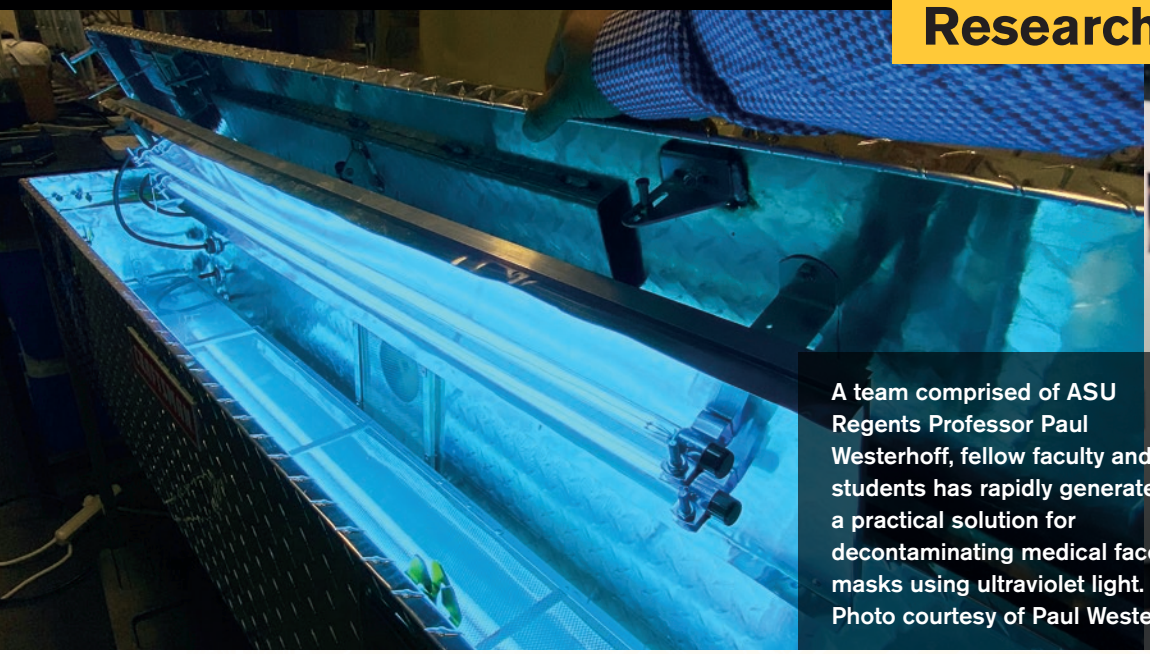
This reliable process has been enacted around the world for decades, but the methods of concrete construction may be changing. Recent advances in materials science, robotics and other fields are permitting concrete to be 3D printed at building sites. Projects in Europe and Asia have already printed entire houses.

With a vision to establish that community, Neithalath and four colleagues at other universities have been awarded a **$2 million, five-year grant** from the **National Science Foundation's AccelNet program** supporting the establishment of collaborative links to address challenges in science and engineering. Neithalath and his co-principal investigators on the grant are creating a "network of networks" called 3DConcrete to share knowledge and opportunities across 13 countries.

In addition to faculty peer relations, 3DConcete will support student exchanges among member institutions. Participants may spend eight weeks at another university domestically or abroad to see how others are working in the field, including engaging with companies that are affiliated with those universities.

Narayanan Neithalath

"3D printing has several advantages over conventional concrete construction," **says Professor Narayanan Neithalath.** ***"We can reduce material waste by half, and we also can create unconventional structures. But realizing the advantages requires a community to research and develop the tools, techniques and standards to make this innovation into a more broad-based reality."***



A team comprised of ASU Regents Professor Paul Westerhoff, fellow faculty and students has rapidly generated a practical solution for decontaminating medical face masks using ultraviolet light. Photo courtesy of Paul Westerhoff

ASU rapidly engineers solution for medical staff battling COVID-19

On the third Saturday of March, only a few days after Arizona State University directed its community to work remotely in response to the COVID-19 pandemic, **Paul Westerhoff** received an email from a fellow faculty member in the **Ira A. Fulton Schools of Engineering**.

He learned that a doctor at a major hospital chain in Phoenix was seeking help with an urgent problem. The novel coronavirus had triggered a global surge in demand for personal protective equipment, or PPE, and his hospital was running out of face masks. Westerhoff contacted the doctor that same day.

The physician wanted a way for hospital staff to sanitize masks themselves, so Westerhoff shared the idea of creating a device for on-site disinfection using germicidal ultraviolet, or UV-C, light.

As a Regents Professor in the **School of Sustainable Engineering and the Built Environment**, Westerhoff already leads research on the application of ultraviolet light to decontaminate water. He also works with ASU School of Molecular Sciences Professor Pierre Herckes on a project investigating aspects of PPE use in semiconductor fabrication clean rooms. Consequently, the scientific background to solve the hospital's problem seemed firmly in place.

Within four days, Westerhoff's team had conducted several experiments and assembled a successful prototype device.

Within only a few more days, Westerhoff had applied for a $150,000 National Science Foundation **Rapid Response Research (RAPID)** grant to help fund the effort, and it was subsequently approved. By the beginning of April, his team had a fully developed device ready for deployment. As explained in the operator's manual they wrote, it can simultaneously disinfect 16 N95 masks within two minutes.

According to Westerhoff, the team's decontamination device may not ultimately represent an ideal tool for hospitals. He says a typical facility uses more than 5,000 N95 face masks each week, and that volume negates the utility of their innovation, even with its remarkably quick disinfection process.

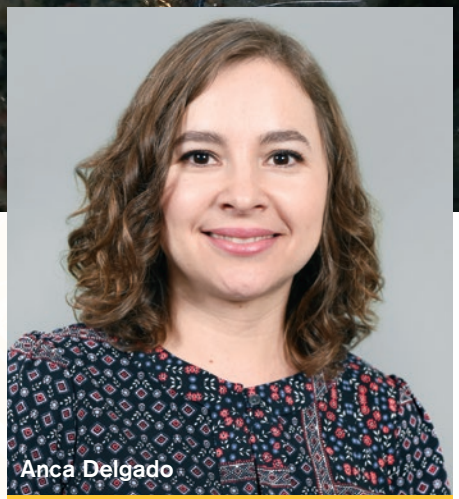
"Instead, we have a real opportunity to support emergency response units," he says. "Fire and ambulance crews respond to events in small groups, and then return to their stations for long intervals. The nature of their work lends itself to convenient, on-site mask disinfection in the numbers that our device can support."

Microbial remedies target chemical threats to the environment

Across America, hazardous waste sites pose an ongoing threat to human and environmental health. The most severe cases are known as Superfund sites, of which over 1,000 currently exist. Some 50 million Americans live within 3 miles of one of these zones, potentially placing them at increased risk for cancer and other serious diseases.

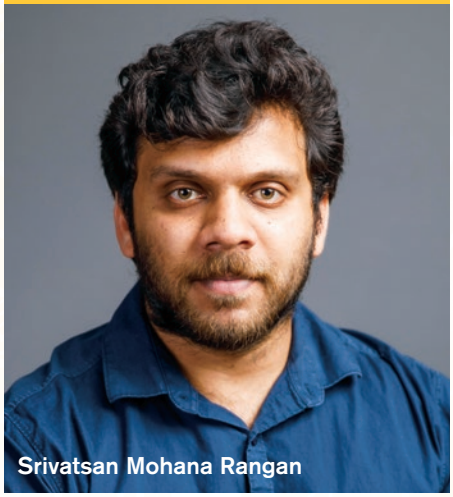
While decontamination of such sites is a public health priority, the technical challenges are daunting. Of particular concern are a pair of chlorinated chemicals: trichloroethylene, known as TCE, and perchlorate. TCE was widely used as a degreasing agent and perchlorate is used in the manufacture of propellants. Due to the widespread reliance on these chemicals in the past and their improper disposal, they have often found their way into the environment, posing significant risks to human health and surrounding ecosystems.

Research in ASU's Biodesign Center for Environmental Biotechnology is demonstrating that a form of microbial life can be effective in cleaning up the areas known as Superfund sites that are contaminated by those chlorinated chemicals. Among leaders of the research are **Anca Delgado**, assistant professor of civil, environmental and sustainable engineering, and **Srivatsan Mohana Rangan**, a SSEBE graduate research assistant in the same field. Rangan is lead author of the study on the project published in the current issue of the research journal Environmental Science & Technology. The news is also reported on *News-Medical.Net*.

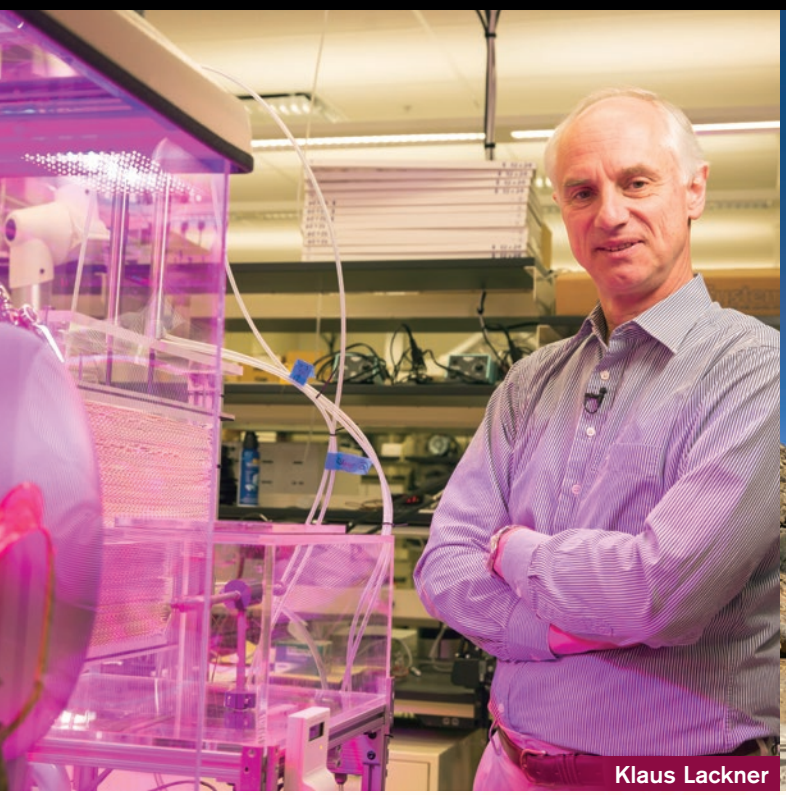


Anca Delgado

"We hope this study will help inform remedial design at Phoenix Goodyear Airport North Superfund Site and other contaminated environments where chemical reductants such as Fe0 are used to promote long-term and sustained microbial activities in the soil and groundwater," **said Anca Delgado, co-author of the new study.**



Srivatsan Mohana Rangan



Klaus Lackner

Artist concept of the "MechanicalTree," a device developed by Klaus Lackner and commercialized by Silicon Kingdom Holdings, Dublin, that can remove carbon from the air. Photo by Silicon Kingdom Holdings

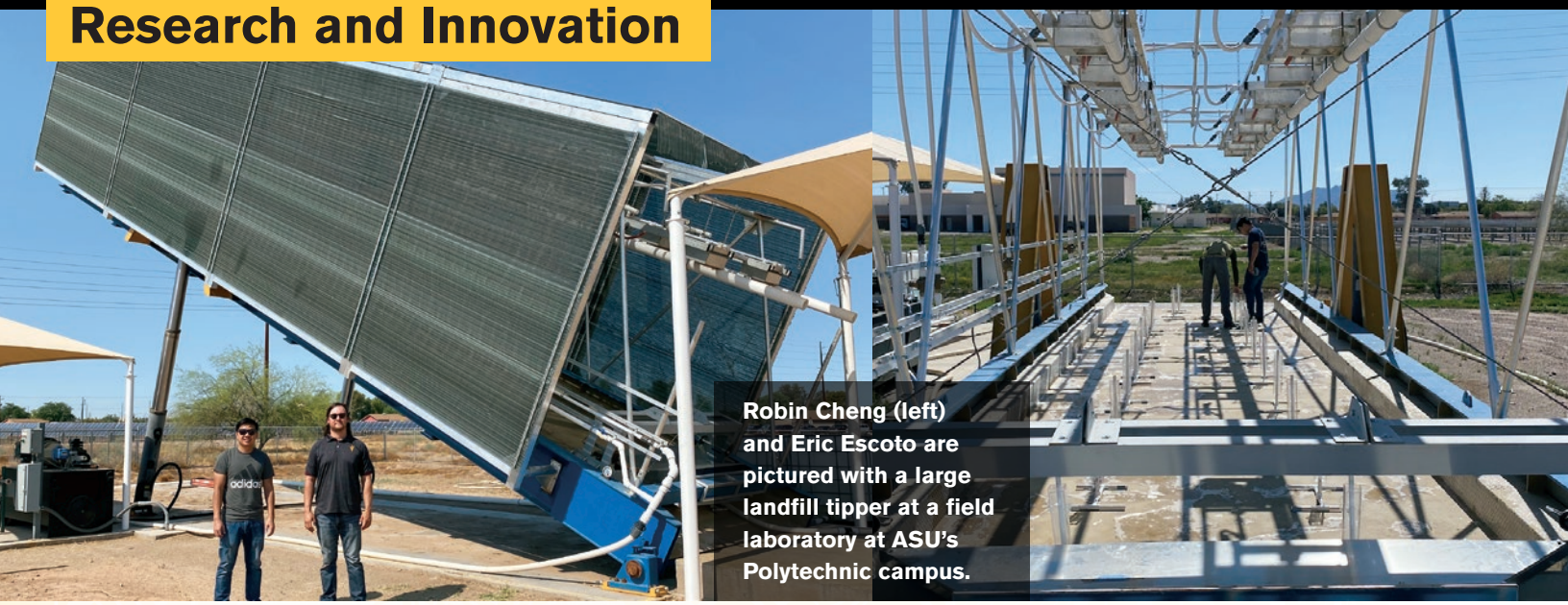
Lackner's carbon-capture technology moves to commercialization

Powerful 'mechanical trees' can remove CO_2 from air to combat global warming at scale

Klaus Lackner, professor in the School of Sustainable Engineering and the Built Environment, a pioneer in the field of negative carbon emissions, has developed a device, called the **"MechanicalTree"** that acts like a tree but is thousands of times more efficient at removing CO_2 from ambient air. The MechanicalTree, which is being commercialized by Silicon Kingdom Holdings of Dublin, Ireland, allows the captured gas to be sequestered or sold for reuse in a variety of applications, such as synthetic fuels, enhanced oil recovery or in food, beverage and agriculture industries.

Sorbent materials to capture the carbon are at the heart of Lackner's device.

Unlike other carbon capture technologies, SKH's technology can remove CO_2 from the atmosphere without the need to draw air through the system mechanically using energy intensive devices. Instead, the technology uses the wind to blow air through the system. This makes it a passive, relatively low-cost and scalable solution that is commercially viable. If deployed at scale, the technology could lead to significant reductions in the levels of CO_2 in Earth's atmosphere, helping to combat global warming.



Robin Cheng (left) and Eric Escoto are pictured with a large landfill tipper at a field laboratory at ASU's Polytechnic campus.

Seeking solid scientific ground for engineering soil sustainability

Soil erosion is a growing worldwide challenge. Its spread threatens dire consequences for the health of fragile environments and the stability of natural resources, agriculture, civil infrastructure and other essential foundations of society.

That's why engineers and scientists are employing advanced technologies — sensing systems, laser-based ground surface change detection and monitoring devices and highly precise measurement tools — to better observe, prevent or reduce soil erosion. In some cases, they even induce it for experimental purposes.

Those mechanisms have been incorporated into an installation called the Large Outdoor Rainfall and Infiltration Simulator, or LORIS, at the **Center for Bio-mediated and Bio-inspired Geotechnics**, or CBBG, Soils Field Laboratory on Arizona State University's Polytechnic campus. The structure is the defining project in **Eric Escoto's** research as a geological sciences doctoral student in ASU's School of Earth and Space Exploration.

Through the facility's capabilities, Escoto hopes to contribute to the development of more effective methods of large-scale erosion control and reduction of soil loss.

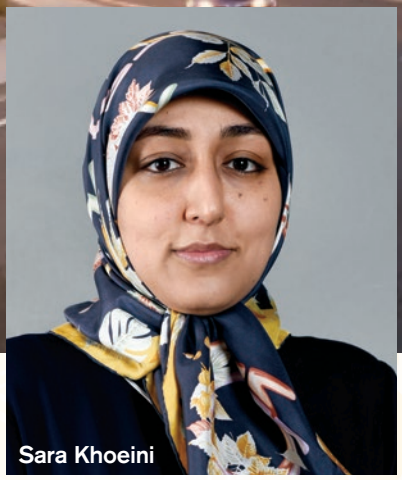
Bolstering resilience to the erosive impacts of wildfires, earthquakes, flooding and other extreme events — as well as human actions that alter ecosystems — is critical to the sustainability of communities' water, power, transportation, waste control and public safety systems.

The work is part of CBBG's mission as a National Science Foundation, or NSF, Engineering Research Center at ASU. The center is directed by **Edward Kavazanjian**, an ASU Regent's Professor and the Ira A. Fulton Professor of Geotechnical Engineering.

Escoto's advisor is **Enrique R. Vivoni**, a professor on the faculties of both the School Sustainable Engineering and the Built Environment and the School of Earth and Space Exploration.

A significant feature of the rainfall simulator is the "landfill tipper" used to elevate the soil test bed, Kavazanjian says. Tippers are commonly used to empty municipal solid waste transfer trailers at landfills. They can tilt the trailers by an angle of up to 45 degrees so the waste material falls completely out of the trailer and onto landfill surfaces.

LORIS is one of only four facilities of its kind in the United States, Kavazanjian points out. The others are a U.S. Department of Agriculture facility at Purdue University, a commercial facility in South Carolina and another research installation at Texas A&M University.


Sara Khoeini

TOMNET center explores public outlook on evolving transportation landscape

Designs, concepts and prototypes for technologies to make transportation more efficient and economical are under development in many research labs and automotive industry facilities. But innovations that improve performance and broaden options for transport are not enough to ensure progress in those efforts will fulfill their potential.

The success of technologically advanced means of automated movement of people, products and services depends just as much or more on public attitudes, values, perceptions and willingness to embrace new and different things.

Autonomous vehicles, or AVs for short, offer a particular case in point. Often called self-driving vehicles, AVs are likely the most transformative of emerging technologies that will impact our evolving "transportation ecosystem," said Professor **Ram Pendyala**, director of the **Center for Teaching Old Models New Tricks**, or TOMNET, a Tier 1 University Transportation Center sponsored by the U.S. Department of Transportation.

Equipped with arrays of sophisticated sensors and automated control systems that enable more acute awareness and responsiveness to surrounding roadway environments, AVs are potentially capable of driving more safely and skillfully than people.

Yet many people remain staunchly skeptical and uncomfortable with driverless vehicles, some saying they would never purchase or even ride in one. Others are eager to see AVs become widely used, said Pendyala.

Preparing the public for emerging transportation scenarios

Some people look at AVs as "personal chauffeurs" that can make traveling easier by relieving them of the pressures of navigating traffic, said **Sara Khoeini**, TOMNET's assistant director and an assistant research professor in SSEBE.

Some react positively to the possibilities AVs present for ride-sharing, while others have little interest in sharing vehicles — or in giving up their position of control behind the steering wheel, even though they acknowledge the safety benefits of automated transportation.

Such varying viewpoints are challenging for transportation planning agencies whose job it is to accurately forecast travel demands, trends and choices.

It's part of the mission of TOMNET to provide data and behavioral insights into how the public will or will not adopt and adapt to various new transportation technologies and services that continue to be rather unsettling to many.

Multiple factors shape attitudes toward alternative technologies

Results of the TOMNET/D-STOP Transformative Technologies in Transportation (T4) Survey provide extensive data about public attitudes and sociological factors likely to shape the public's responses to alternative mobility technologies and services, said Khoeini, who led the large multi-institutional survey project team.

In addition to autonomous vehicles, the survey covers public perspectives, opinions and preferences on mobility-on-demand services such as Uber and Lyft, and bike and e-scooter sharing systems such as Bird and Lime.

The project's ultimate goal, Khoeini said, is to help pave the way for mobility technologies and services "to create a future transportation system that improves our quality of life."

Research at the Arizona Center for Algae Technology and Innovation, or AzCATI, on Arizona State University's Polytechnic campus is laying groundwork for algae-based technologies and systems to provide cleaner fuels, efficient wastewater treatment, environmental restoration and renewable chemical feedstocks.

Algae engineering: stepping stone to sustainable solutions

Among ways being explored to combine biology and engineering to remedy a range of growing global environmental problems, algae-based solutions look especially promising. The encouraging viewpoint stems from progress in research that is revealing how the properties of algae can be harnessed to become the driving force for productive biotechnological pursuits.

Some of the research findings have been the result of efforts based at the **Arizona Center for Algae Technology and Innovation**, or AzCATI, embedded in the School of Sustainable Engineering and the Built Environment.

Algae is an abundant and widely varied group of aquatic organisms capable of producing oxygen through photosynthesis and thereby harvesting energy from sunlight to grow and produce a range of biochemicals. That capability and related characteristics can make algae a useful component in the development of advanced systems for effectively treating wastewater, producing cleaner energy and new biofuels, reducing harmful carbon dioxide emissions and improving decontamination and pollution control techniques.

Engineers and scientists say the chemical components in algae can also strengthen materials used to build transportation systems and other public infrastructure — while sequestering carbon in the process to substantially boost the sustainability of both natural and built environments.

AzCATI launched in 2010 with a multimillion investment from **Science Foundation Arizona**, a nonprofit with the mission of diversifying Arizona's economy by aligning university research with the needs of industry.

AzCATI's leaders say many students and others who have worked at the center have gone on to use what they learned from the experience in their careers.

More than 150 ASU students have received valuable research experience at the algae research center during its 10 years of operation.

Peter Lammers (above), research professor, studies algae from acidic hot springs, applying his knowledge of molecular biology and environmental chemistry to create large-scale carbon-foundries that will fuel the future carbon economy.

The foundation's support financed the development of several acres of algal growth ponds on ASU's Polytechnic campus — located close to biochemical and molecular biology labs with resources available for use in AzCATI's projects, particularly the cultivation of algal biomass for biofuels.

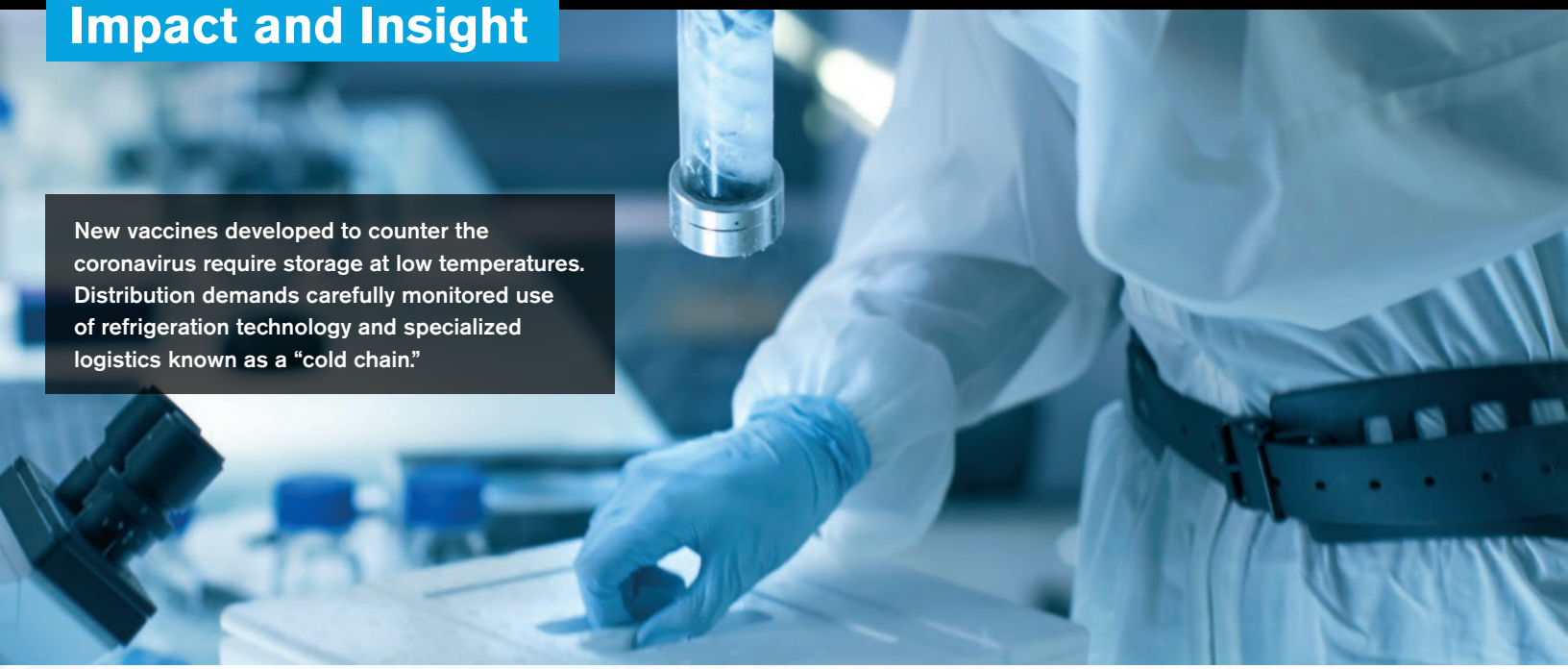
Before long, the center became one of the major testbeds for algae biotechnology derived products, including nutraceuticals, biofuels, food and feed and high value pharmaceuticals — all from algae biomass. This was possible due in large part to the Department of Energy-funded **ATP^3 consortium**, which is designed to accelerate research and development of algae-based technologies.

AzCATI has been able to draw on a broad array of engineering and science resources and expertise, helping the center attract close to $70 million from public agencies, industry and foundations — as well as partnering with startups to obtain small business innovation grants — leading to significant expansion of AzCATI's activities during its first decade.

Over that time, the use of algae in products has notably increased. Algae is now an ingredient in foods (for humans and animals), cosmetics, nutritional supplements like omega-3 oils, antioxidants, coloring agents, dyes for fabric, sunblock lotion, printing ink, flour and paper, among many other consumer products.

Research by SSEBE colleagues outside of AzCATI meshes with the center's goals and helps support its ongoing projects.

Associate Professor **Elham Fini** is using an additive derived from algae to boost the resilience and reduce the emissions of asphalt—which is especially important in hot and sunny Arizona. Professors **Bruce Rittmann** and **Rolf Halden's** work focuses on finding more effective methods of protecting and restoring the health of ecosystems. In his **Center for Negative Carbon Emissions**, Professor **Klaus Lackner** is developing carbon capture technology to help pull harmful greenhouse gases out of the atmosphere.



New vaccines developed to counter the coronavirus require storage at low temperatures. Distribution demands carefully monitored use of refrigeration technology and specialized logistics known as a "cold chain."

Cold storage is crucial to COVID-19 vaccine distribution

Recent news about the coronavirus pandemic has been both harrowing and hopeful. Infections in the United States now exceed 13 million.

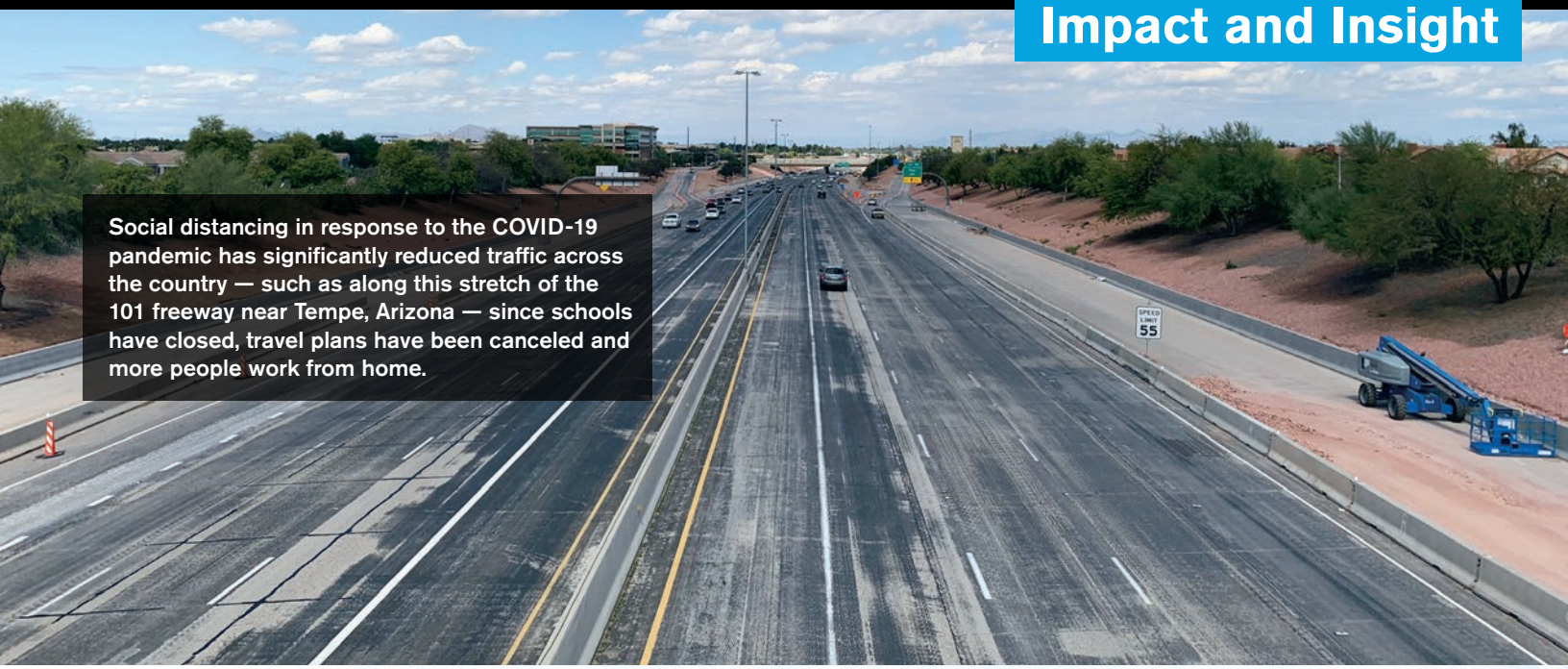
Amidst this surge, the results of large clinical trials by pharmaceutical companies show new vaccines are 94% effective or higher. Consequently, corporations are seeking emergency-use authorization from the Food and Drug Administration to start vaccinations within weeks.

These breakthroughs are very welcome in a year defined by the heavy toll of the COVID-19 pandemic. But supplying these vaccines requires a feat of logistical precision known as a "cold chain." The solutions must be stored at low temperatures: 40 degrees Fahrenheit for the AstraZeneca product, minus 4 degrees Fahrenheit for the Moderna product and minus 94 degrees Fahrenheit for the Pfizer product. Exposure to warmer conditions, such as in transit from production facilities to storage sites, could compromise their potency and undermine the battle against the coronavirus.

Associate Professor **Kristen Parrish**, researches the integration of energy efficiency into building design and operational processes. Her recent work includes innovating the cooling technology used in commercial freezer facilities by incorporating **phase-change materials**. These materials are salt hydrates in sheets of units that look like ketchup packets. When heat seeps into a freezer, for example, these passive materials absorb that heat and keep temperatures lower for longer. They don't help you get to the low temperature you need, but they can help you stay there with less energy demand.

Kristen Parrish

Parrish stated that *"Distribution will demand lots of dry ice and ultra-cold freezer units."*



Social distancing in response to the COVID-19 pandemic has significantly reduced traffic across the country — such as along this stretch of the 101 freeway near Tempe, Arizona — since schools have closed, travel plans have been canceled and more people work from home.

COVID-19 may alter the future of how we navigate work and leisure

There has been a significant drop in automobile use both across Arizona and throughout the country in the wake of the COVID-19 outbreak.

According to **Ram Pendyala**, director of the School of Sustainable Engineering and the Built Environment Phoenix traffic reduced by 30% or more since schools closed and businesses encouraged workers to stay home to help control the spread of the virus in the months following the outbreak.

"Many people have been working remotely as part of social distancing measures to combat COVID-19," Pendyala said. "Such measures certainly have an impact on human activity. From a transportation perspective, it means reduced traffic and energy consumption, cleaner air and less wear and tear on our roads — all good things for sustainability."

"But the lack of traffic is not really a good thing. Traffic is a sign of economic and social vitality. Mobility is a sign that people are interacting with each other, businesses are thriving and society is functioning. It's only the adverse effects of traffic that we don't want."

Forecasting travel demand to better manage traffic, promote sustainable transportation and support infrastructure planning is a focus of Pendyala's work. His research into human preferences and behaviors related to transportation offers insights on the impact of social distancing during the COVID-19 outbreak in America.

He is currently serving as a co-PI on an NSF RAPID grant led by Professor Deborah Salon of the School of Geographical Sciences and Urban Planning to collect data about people's adaptation to COVID-era circumstances over time.

Pendyala notes that the many weeks of disruption can have a significant impact on how we plan to spend our time.

"But much depends on how employers, schools, businesses, and people adapt," he said. "We are already seeing people rebound to their previous habits rather quickly, and traffic is recovering to pre-pandemic levels." At the same time, Pendyala noted that a number of permanent behavioral changes may persist to some degree, including higher degrees of work from home, lower levels of transit use and air travel, and greater use of online shopping and food delivery services. All of these changes will have implications for infrastructure planning for the future.

Ram Pendyala

"This experience could prompt us to think differently about the nature of work in the future," Pendyala said. "On the one hand, we all enjoy the first weeks of telecommuting but then workers begin to feel isolated and employers start getting concerned about productivity. We might see some increase in people working remotely on a permanent basis, but likely for only a part of each week, as opposed to the full-time telecommuting we see now."

Step into the Future. A city of 50 million people is no longer just a city. It's a MEGA CITY. How will civil engineers accommodate a population so large, while preserving the city's historic character, promoting accessible green space and supporting a diverse array of lifestyles and economies? Photo: ASCE

Today's engineers, builders already envisioning tomorrow's infrastructure

Evolution of future cities was focus of Construction Research Congress at ASU

Climate change, alternative energy, autonomous vehicles and high-tech construction systems are changing the way the built environment — the man-made infrastructure in which we live and work — is being planned by today's engineers and builders.

The technologies that will identify and solve the challenges of future cities were the subjects of presentations, workshops and panel discussions at the **American Society of Civil Engineers (ASCE) Construction Research Congress (CRC)** held at Arizona State University and hosted by the **Del E. Webb School of Construction**.

While smart cities and mega cities are already being built, cities of the future need to meet broader societal needs.

For example, for those who will be affected by climate change, like 60% of the global population that live in coastal areas vulnerable to rises in sea levels, floating city planning is one of the solutions being proposed by the ASCE in its **"Future World Vision: Infrastructure Reimagined"** project.

"How will our world look in 25 years?" asked Katerina Lachinova, director of the ASCE Construction Institute during the conference as she addressed the challenges of construction research and innovation needed to transform society. "Fifty years? One hundred years?"

Lachinova identified five types of future cities in which designers and constructors will depend on engineering knowledge to develop computer modeling tools to design the infrastructure of the future, including a frozen city and an off-world city.

The theme of the conference **"Construction Research and Innovation to Transform Society**," addressed how the construction industry, including civil, industrial, building and cyber infrastructure engineers, must evolve to support sustainable, resilient communities of the future.

The conference received 900 abstracts, published 481 peer-reviewed articles (a CRC record) and had participants from 24 countries with presentations in six primary tracks including infrastructure systems and sustainability; health, safety and workforce; computer applications and simulation; and advanced technologies and data analytics.

Consistent through all the tracks was the expanding use of data analytics, artificial intelligence and virtual reality — tools not traditionally available in the construction worker's toolbox, noted El Asmar.

"Despite the barriers presented by the unfortunate coronavirus situation, we had a very successful sharing of insights, practices and visions of the future. It was a true honor to host **CRC 2020** at ASU and we look forward to CRC 2022 hosted by Virginia Tech in Washington, D.C.," El Asmar concluded.

Mounir El Asmar

"This event has brought together a global network of construction stakeholders who shared the state-of-the-art in research and applications for tackling the challenges of the 21st-century construction industry," said Mounir El Asmar, conference chair and associate professor in the School of Sustainable Engineering and the Built Environment.


Irrigation at Encanto Golf Course in Phoenix.


FiSensors buried to monitor soil moisture and temperature

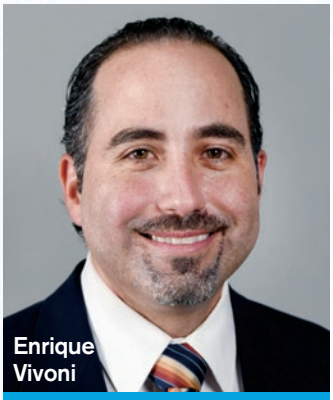
Oasis effect in urban parks could contribute to greenhouse gas emissions

Some potentially significant revelations about the impacts of irrigation used to make public spaces greener and cooler — especially in hotter locales such as the Phoenix area — have been discovered by hydrologist **Enrique Vivoni**, a professor in the School of Sustainable Engineering and the Built Environment and the School of Earth and Space Exploration. Aided by graduate students **Mercedes Kindler**, **Zhaocheng Wang** and **Eli Pérez-Ruiz**, Vivoni used an array of sensing technologies to measure the effects of irrigating one of Phoenix's urban golf courses. Their year-long study showed a connection between the evaporation of water on the course and the resulting amounts of carbon dioxide emissions, which could contribute to global warming. The story is also reported in ***Science Daily*** and ***Phys.Org*** and the results of their study were recently published in ***Geophysical Research Letters***.

Vivoni and his team identified that the park showed what meteorologists call the "oasis effect," which refers to the creation of a microclimate that is cooler than a surrounding dry area due to the evaporation of a water source.

To measure the oasis effect at Encanto Golf Course, Vivoni and his team used special sensors at a weather station located within the park. These sensors measured water and energy fluxes along with carbon dioxide exchanges depicting plant photosynthesis and respiration.

While additional studies are needed to determine when during the day it would be preferable to irrigate, making this management change would decrease evaporative loss and the carbon dioxide emissions — which contribute to global warming — during hot, dry, windy days.


Enrique Vivoni

"Because of the oasis effect, when we irrigate our urban parks at night, we lose vast amounts of water and we see increased carbon dioxide emissions, which could lead to higher global warming potential," **Vivoni said.** ***"This has important implications for water conservation and greenhouse gas emission management in desert cities such as Phoenix."***

Mapping the way to resilient cities

ASU-led project will bring researchers, communities together to forge designs for resilient urban infrastructure

Alarm is sounding to warn that the structural foundations that have long enabled major cities to function productively in the past won't provide a reliable template for the future.

This is most evident when it comes to public infrastructure, says **Mikhail Chester**, an associate professor of civil, environmental and sustainable engineering.

Chester and other experts say the power, water and transportation systems that have been relied upon to provide stable foundations for growing urban areas must be reinforced or even "reimagined" to withstand the one thing that is changing in a significant and precarious fashion: the climate.

"Extreme events are going to be a chronic problem for our built environment, especially in urban centers." Chester says. "We need to rethink how we design infrastructure for environmental extremes and how we position our communities to be prepared for these events."

He and colleagues at ASU and elsewhere are progressing on multiple related efforts to help cities confront the challenge.

Chester has the lead role in an extensive five-year endeavor, funded by a **$3.5 million grant** from the **National Science Foundation's Growing Convergence Research program** to create platforms for the **development of social, ecological and technological infrastructure systems for urban resilience**.

The team's goal, Chester says, is to "identify cutting-edge transition strategies" for cities to follow in strengthening urban infrastructure systems against extreme weather events they will likely face throughout the 21st century.

Atlanta, New York, Phoenix and San Juan are the test cities selected for the project. These cities represent a diverse array of climatological conditions and extreme weather events, as well as various existing infrastructure conditions and socioeconomic profiles, Chester says.

The intensity of storms, hurricanes, floods, wildfires and heat waves resulting from climate change can pose serious threats to the stability of public infrastructure, such as bridges.

The detrimental impacts of extreme weather events on public services such as electrical power could be especially severe in high-density urban areas in which more people, buildings and infrastructure systems could be affected.

Urban transportation systems — especially freeways — are a key focus of city leaders concerned about the vulnerability of public infrastructure to the potential damage that could be inflicted by severe weather exacerbated by climate changes.

Structure age, collision event and fire could all be contributors to collapse of Tempe railway bridge

Three cars derailed during the July 29 incident and landed on dry land below the bridge.

Beyond determining precisely what led to the recent train derailment, bridge collapse and resulting fire on the Union Pacific Salt River Bridge over Tempe Town Lake near ASU, other questions must be answered about the impacts of the incident to adequately assess how to effectively repair and rebuild the damaged sections of the bridge and the rail line.

SSEBE engineers **Barzin Mobasher**, **Samuel Ariaratnam**, **Anthony Lamanna**, **Narayanan Neithalath**, **Subramaniam Rajan** and **Ram Pendyala** point to many technical considerations that must be taken into account to guide restoration of the structure, particularly the replacement of steel, concrete and other construction materials that will be necessary. The full interview is available at: ***https://asunow.asu.edu/20200730-solutions-asu-engineer-bridge-infrastructure-outdated***

One thing is certain, the engineers say, railway bridges are critical links in the country's freight transportation network and any prolonged delay in their repair is disruptive to businesses and communities that rely on what railways deliver.

ASU alumni deliver COVID-19 relief for Native American communities

The **First Peoples' COVID-19 Resource Drive** is an initiative to supply much needed supplies to tribal communities struggling with the impact of the pandemic. Created and managed by a team of Arizona State University alumni, the group's first project sent emergency supplies to Navajo and Hopi communities.

The second drive took place on June 25 at Sun Devil Stadium. Three moving trucks full of supplies were dispatched to Navajo, Hualapai, Havasupai and White Mountain Apache communities.

"Tribes are resilient and determined to see through this pandemic just as our ancestors have in times past," said Denetdale. "We thank all those who volunteered, gave monetarily or donated items and time to come support the First Peoples' COVID-19 Resource Drive."

The team is developing a plan to continue supporting tribal communities of Arizona as long as they are affected by COVID-19.

"Initiatives like the First Peoples' Drive assist tribal governments and agencies with relief efforts," **said Marcus Denetdale, program director for ASU's Construction in Indian Country Program in SSEBE.** ***"In this case, the supplies went directly from Sun Devil Stadium to tribal doorsteps in three days or less. These supplies help low-income families economically and, perhaps more importantly, keep elders and high-risk citizens from going into harm's way — stores and public gathering places — for essential items."***

Joy Marsalla earned her master's degree at ASU in 2012 and is working at Nike as a Sustainable Chemicals Manager.

Through ASU's Fulton Undergraduate Research Initiative, she continued work in environmental microbiology to develop a new method of drinking-water disinfection. Marsalla's honors thesis through Barrett, the Honors College, focused on wastewater wetlands.

Her combined academic and research performance got her into leading engineering societies and organizations—Tau Beta Pi, Chi Epsilon and the Arizona Association of Environmental Professionals. Marsalla was one of only 35 students nationwide to receive a fellowship from Tau Beta Pi, the national engineering honor society.

EnKoat, an advanced materials company founded by SSEBE alumni **Aashay Arora**, PhD and **Matthew Aguayo**, PhD, that is developing energy efficient building coatings to combat climate change is named in Cleantech Group's "New 50 to Watch" List as one of the companies finding solutions to combat the climate crisis. EnKoat secured Phase 1 funding from the NSF SBIR Program.

Yung Koprowski brings wealth of transportation knowledge to Gilbert Town Council. Her appointment lasts through the end of 2022.

Dean S. Papajohn, PhD (2019), PE was awarded the 2020 McDonald Mentor Award by Tau Beta Pi.

Dr. Janaka Ruwanpura (MS Construction '97) received the Calgary International Achievement Award. He was also inducted into the SSEBE Academy of Distinguished Alumni at the 2019 celebration.

Dr. Mena Souliman, associate professor of civil engineering at The University of Texas at Tyler received a $400,000 UT System Science and Technology Acquisition (STARs) Award to address the future challenges of the US transportation system.

Ming Xu, PhD, was promoted to Full Professor at University of Michigan, Ann Arbor.

Industry Engagement

Prevention through Design 2020 Workshop

Current and future state-of-the-art on research, practice and education

The National Institute for Occupational Safety and Health (NIOSH) held the first Prevention through Design Workshop 2020 at Arizona State University. The workshop, organized by members of the Del E. Webb School of Construction including **Edd Gibson**, professor and **David Grau**, associate professor was the very first scientific meeting of its kind. The workshop focused on state-of-the-art Prevention through Design (PtD) research, practice, and education efforts from engineering, design, contractor, client, U.S. and international academics and universities. This is the first of five annual PtD workshops planned between 2020 and 2024, funded through a NIOSH grant at Arizona State University.

FOCE² Friends of Civil & Environmental Engineering

SSEBE continues to support our students through our partnership with the **Friends of Civil and Environmental Engineering**, a group of industry members dedicated to assisting students achieve their success. We wish to express our appreciation to these firms and the Steering Committee and encourage you to join them. Visit our website for membership details.

ssebe.engineering.asu.edu/foce2

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Bowman Consulting
Carollo Engineers
CivTech Inc.
Coe & Van Loo Consultants, Inc.
Cole Design Group
Dibble Engineering
Entellus, Inc.
Gannett Fleming
GHD
HilgartWilson
Kimley-Horn
Markham Contracting Co., Inc.
Prelude Engineering Consultant Services
Premier Engineering
Speedie & Associates
Terracon
T & S Diversified
United Civil Group
Wood, Patel & Associates
Arizona Department of Transportation (ADOT)
City of Glendale
City of Phoenix
Town of Gilbert

FOCE² Steering Committee

Bruce Larson, Bowman Consulting (Chair)
Ron Hilgart, HilgartWilson (Past Chair)
Aubrey Thomas, HilgartWilson
Bob Stanley, Gannett Fleming
Chris Kmetty, Markham Contracting
Dallas Hammit, ADOT
Dan Meyer, Black & Veatch
Frederick Tack, GHD
Gregory Haggerty, Dibble
Jason Pagnard, Burgess Niple
Jim Geiser, Prelude Engineering
Michael Worlton, GHD
Rob Lyons, JE Fuller
Ron Serio, City of Glendale

External Advisory Board Members

Civil, Environmental & Sustainability

Jonathan Fuller
Principal,
JE Fuller Hydrology & Geomorphology

Jim Geiser
Principal, Prelude Engineering

Gregory Haggerty
CEO, Dibble Engineering

Andrew Johnson
Water Engineering Manager,
SRP

Chris Kmetty
Construction Engineering Manager,
Markham Contracting

Bruce Larson
Regional Manager,
Bowman Consulting

Eric Laurin
Associate/Director,
Coe & Van Loo Consultants

Dan Meyer
Sr. Vice President,
Black & Veatch

Les Olson
Consultant, Coe & Van Loo *(retired)*

Frederick Tack
ASCE Phoenix Branch President,
GHD

Jennifer Toth
Transportation Director,
MCDOT

Del E. Webb School of Construction

Chad Buck
SVP, Building, Southwest, Sundt

Jeff Ehret
CEO, Penta Building Group

Danielle Feroleto
Owner & President, Small Giants

Mike Godbehere
President, GCON

Michael Gonzalez
Vice President, McCarthy Building

James Hatch
Vice President, Pre-Construction Sales, Kovach

Bill Headley
Senior Vice President,
Holder Construction

Jay Layton
Arizona Executive Vice President,
TD Industries

Tom Melton
Superintendent,
JE Dunn Construction

James Murpy
CEO, Willmeng

Bill Okland
CEO, Okland Construction

Steve Spears
Senior Project Consultant,
Coreslab Structures

Dennis Tsonis
Senior Vice President,
Lovitt & Touche

Robert Roessel
Executive Principal, SRP

Construction Engineering

Gregory Ayres
Vice President,
Sundt Construction

Darrin Francom
Engineering Manager,
Central Arizona Project

Michael Gonzalez
Director SW Division,
McCarthy Building Companies

Mike Kemper
Executive Vice President,
Quanta Services Mears Group

Keith London
President/CEO, Kennedy/Jenks Consultants

John Mistler
Executive Vice President,
First Fidelity Bank

Steve Mortensen
Retired CEO, Project Engineering Consultants

Scot Schlund
Managing Senior Principal,
Stantec Consulting

Dave Sobeck
Vice President, Carollo Engineers

Willie Paiz
PM/CM Infrastructure Construction,
Jacobs Southwest/ CH2M Hill

Environmental Engineering

Maria Brady
Principal, AZ Water Sector Leader,
Stantec

Zaid Chowdhury
Water Technology Director, Garver

Curtis Courter
Associate Vice President,
Hazen and Sawyer

Kirk Craig
Senior Principal Engineer,
Geosyntec Consultants

Daniel Gleiberman
Manager, Sloan Valve Co.

Charlie He
Associate Vice President,
Carollo Engineers

Brandy Kelso
Water Services Assistant Director,
City of Phoenix

Mike Krebs
Vice President PACE, Advanced Water Engineering

Laurie LaPat-Polasko
Vice President, National Director of Remediation, Matrix New World Engineering

Craig McCurry
Sr. Environmental Engineer,
Intel Corporation

Elaine Wilson
Principal Indigenous Environmental Professional, Elaine H. Wilson Consulting LLC

Mike Worlton
Principal (Vice President), GHD

Faculty Expertise

Morteza Abbaszadegan

Professor, Director, NSF WET Center
PhD, University of Arizona
Expertise: Health-Related Water Microbiology

Braden Allenby

President's Professor
PhD, Rutgers University
Expertise: Sustainable Engineering

Absar Alum

Assistant Research Professor
PhD, University of Arizona
Expertise: Pollution Science, Biotechnology

Samuel Ariaratnam

Professor and Construction Engineering Programs Chair
PhD, University of Illinois at Urbana-Champaign
Expertise: Underground Construction

Steven Ayer

Associate Professor
PhD, The Pennsylvania State University
Expertise: Visualization Technologies

Wylie Bearup

Professor of Practice and Beavers-Ames Heavy Civil Engineering Chair
PhD, University of Illinois
Expertise: Public Works

Yuqiang Bi

Assistant Research Professor
PhD, University of Michigan, Ann Arbor
Expertise: Water Quality

Mackenzie Boyer

Lecturer and Assistant Research Professor
PhD, University of Florida
Expertise: Water Conservation

Treavor Boyer

Associate Professor and Environmental Engineering Programs Chair
PhD, University of North Carolina at Chapel Hill
Expertise: Water Treatment

Efthalia (Thalia) Chatziefstratiou

Lecturer
PhD, The Ohio State University
Expertise: Engineering Education

Mikhail Chester

Associate Professor and Director, Metis Center for Infrastructure and Sustainable Engineering
PhD, University of California, Berkeley
Expertise: Sustainable Infrastructure

Oswald Chong

Associate Professor
PhD, University of Texas at Austin
Expertise: Energy and Resource Management

Otakuye Conroy-Ben

Assistant Professor
PhD, University of Arizona
Expertise: Endocrine Disruption

Thomas Czerniawski

Assistant Professor
PhD, University of Texas at Austin
Expertise: Computer vision and digital modeling of the built environment

❖ **New faculty**

Paul Dahlen

Assistant Research Professor
PhD, Arizona State University
Expertise: Hydrocarbon Remediation

Faculty Expertise

Wanda Dalla Costa

Associate Professor
MA, University of Calgary, MDR, Southern California Institute of Architecture
Expertise: Indigenous Architecture

Anca Delgado

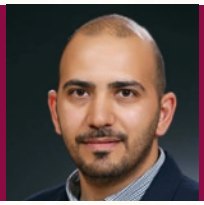
Assistant Professor
PhD, Arizona State University
Expertise: Soil Microbial Processes

Mounir El Asmar

Associate Professor
PhD, University of Wisconsin-Madison
Expertise: Construction, Infrastructure

James Ernzen

Associate Professor and PENTA Building Group Chair
PhD, University of Texas at Austin
Expertise: Concrete Materials



Mahmut Ersan

Assistant Research Professor
PhD, Clemson University
Expertise: Water Treatment

Elham (Ellie) Fini

Associate Professor
PhD, University of Illinois at Urbana-Champaign
Expertise: Sustainable Materials
❖ **ASCE Fellow**

Peter Fox

Professor and Graduate Chair
PhD, University of Illinois at Urbana-Champaign
Expertise: Groundwater Recharge

Matthew Fraser

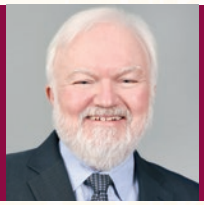
Professor and Associate Director
PhD, Caltech
Expertise: Air Quality

Margaret Garcia

Assistant Professor
PhD, Tufts University
Expertise: Water Resources
❖ **NSF CAREER Award**

Sergio Garcia-Segura

Assistant Professor
PhD, University of Barcelona, Spain
Expertise: Electrochemical Water Treatment
❖ **New Faculty,** ❖ **Elsevier Prize**



G. Edward Gibson, Jr.

Professor and Sunstate Chair
PhD, Auburn University
Expertise: Front-End Planning
❖ **ASCE Distinguished Member**
❖ **Richard L. Tucker Outstanding Service Award**

David Grau

Associate Professor
PhD, The University of Texas at Austin
Expertise: Systems Engineering

Yuanming Guo

Assistant Research Professor
PhD, Arizona State University
Expertise: Environmental Engineering

Rolf Halden

Professor and Director, Biodesign Center for Environ. Health Eng.
PhD, University of Minnesota
Expertise: Water and Health

Nasser Hamdan

Assistant Research Professor and Industrial Collaboration Director, CBBG
PhD, Arizona State University
Expertise: Biogeotechnics, Biogeochemistry

Faculty Expertise

Kerry Hamilton

Assistant Professor
PhD, Drexel University
Expertise: Microbiology and Risk

Keith Hjelmstad

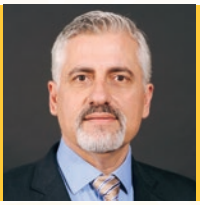
President's Professor and CESE Program Chair
PhD, University of California, Berkeley
Expertise: Structural Engineering

Christian Hoover

Assistant Professor
PhD, Northwestern University
Expertise: Fracture Mechanics

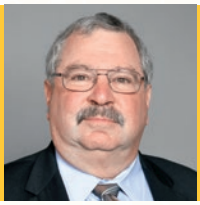
Kristen Hurtado

Assistant Research Professor
PhD, Arizona State University
Expertise: Project Management



Kamil Kaloush

Professor and Director, National Center of Excellence on SMART Innovations
PhD, Arizona State University
Expertise: Pavements and Materials
❖ **FORTA Professor**



Edward Kavazanjian, Jr.

Regents Professor and Director, Center for Bio-mediated and Bio-inspired Geotechnics
PhD, University of California, Berkeley
Expertise: Geotechnical Engineering

Hamed Khodadadi Tirkolaei

Assistant Research Professor
PhD, Eastern Mediterranean University, Cyprus
Expertise: Sustainable Geotechnics

Sara Khoeini

Assistant Research Professor
PhD, Georgia Institute of Technology
Expertise: Transport Modeling

Kraig Knutson

Senior Lecturer
PhD, Arizona State University
Expertise: Construction Methods

Rosa Krajmalnik-Brown

Professor
PhD, Georgia Institute of Technology
Expertise: Microbial Ecology Management
❖ **AZBio Researcher of the Year Award**

Barry Kutz

Lecturer
MS, Arizona State University
Expertise: Preconstruction delivery

Klaus Lackner

Professor and Director, Center for Negative Carbon Emissions
PhD, Heidelberg University, Germany
Expertise: Carbon Sequestration

Anthony Lamanna

Associate Professor and Sundt Professor of Alternative Delivery Methods and Sustainable Development, DEWSC Programs Chair
PhD, University of Wisconsin
Expertise: Sustainable Construction

Peter Lammers

Research Professor
PhD, Portland State University
Expertise: Biotechnology & Bioenergy

Jean Larson

Assistant Research Professor and Education Director, CBBG
PhD, Arizona State University
Expertise: Engineering Education

Faculty Expertise

Christopher Lawrence

Senior Lecturer
PhD, Arizona State University
Expertise: Geotechnical Engineering

Yingyan Lou

Associate Professor
PhD, University of Florida
Expertise: Transportation Modeling

Michael Mamlouk

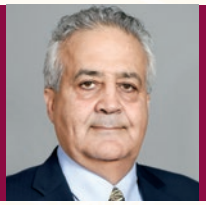
Professor
PhD, Purdue University
Expertise: Pavement Materials

Samuel Markolf

Assistant Research Professor
PhD, Carnegie Mellon University
Expertise: Urban Resilience

Giuseppe Mascaro

Assistant Professor
PhD, University of Cagliari, Italy
Expertise: Stochastic Hydrology



Barzin Mobasher

Professor
PhD, Northwestern University
Expertise: Composite Materials

Rebecca Muenich

Assistant Professor
PhD, Purdue University
Expertise: Watershed Modeling
❖ **New Face of ASABE**

Narayanan Neithalath

Professor
PhD, Purdue University
Expertise: Materials Science

Hasan Ozer

Associate Professor
PhD, University of Illinois, Urbana-Champaign
Expertise: Pavements and Sustainability

Kristen Parrish

Associate Professor
PhD, University of California, Berkeley
Expertise: Construction Management

Ram Pendyala

Professor and Director of SSEBE, Director, TOMNET University Transportation Center
PhD, University of California, Davis
Expertise: Transportation Systems

François Perreault

Assistant Professor
PhD, University of Quebec, Canada
Expertise: Environmental Nanotechnology

Subramaniam (Subby) Rajan

Professor
PhD, University of Iowa
Expertise: Finite Element Analysis

Jafar Razmi

Associate Research Professor
PhD, University of Maryland, College Park
Expertise: Structural Mechanics and Geotechnical

T. Agami Reddy

Professor
PhD, University of Perpignan, France
Expertise: Sustainable Energy

Faculty Expertise

Bruce Rittmann

Regents' Professor and Director, Biodesign Swette Center for Environmental Biotechnology
PhD, Stanford University
Expertise: Environmental Biotechnology

Thomas Seager

Associate Professor
PhD, Clarkson University
Expertise: Infrastructure Systems

Shahnawaz Sinha

Assistant Research Professor
PhD, University of Colorado-Boulder
Expertise: Drinking Water Treatment

Richard Standage

Lecturer
PhD, Arizona State University
Expertise: Concrete Specialist

Peter Stopher

Research Professor
PhD, University of London
Expertise: Transportation Planning

Kenneth Sullivan

Professor
PhD, University of Wisconsin-Madison
Expertise: Procurement and OCM

Junliang (Julian) Tao

Associate Professor
PhD, Case Western Reserve University
Expertise: Bioinspired Geotechnics

Leon van Paassen

Associate Professor
PhD, Delft University of Technology
Expertise: Geotechnical Engineering

Enrique Vivoni

Professor and Associate Dean Graduate College
PhD, Massachusetts Institute of Technology
Expertise: Hydrologic Science

Kristen Ward

Lecturer
PhD, University of Arizona
Expertise: Structural Engineering

Zhihua Wang

Associate Professor
PhD, Princeton University
Expertise: Urban Environment

Paul Westerhoff

Regents' Professor
PhD, University of Colorado
Expertise: Water Treatment
❖ **A.P. Black Award**

Avi Wiezel

Associate Professor and Assistant Dean for Facilities
PhD, Technion-Israel Institute of Technology
Expertise: Human Aspects of Management

Tianfang Xu

Assistant Professor
PhD, University of Illinois, Urbana-Champaign
Expertise: Groundwater Sustainability

Claudia Zapata

Associate Professor
PhD, Arizona State University
Expertise: Unsaturated Soils

Ruijie Zeng

Assistant Professor

PhD, University of Illinois, Urbana-Champaign

Expertise: Hydrologic Modeling

Xuesong Zhou

Associate Professor

PhD, University of Maryland

Expertise: Multimodal Network Planning

Emeritus Faculty

William W. Badger, PhD
Howard H. Bashford, PhD
Allan Chasey, PhD
Apostolos Fafitis, PhD
Sandra Houston, PhD
William Houston, PhD
Paul Johnson, PhD
Larry Mays, PhD
Avinash Singhal, PhD
Matthew Witczak, PhD

Farewell

We thank the following faculty for their service and wish them well.

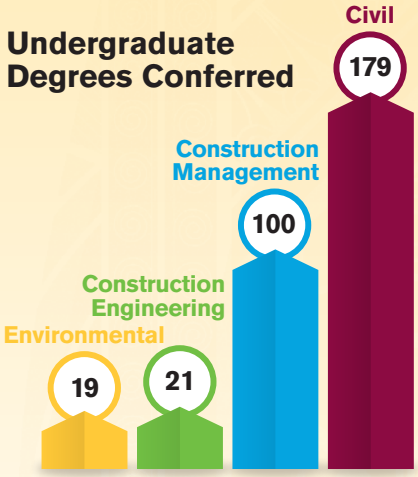
Sandra Houston, Professor, retired May 15, 2020 after 37 years of service to ASU.

Wylie Bearup, Professor of Practice, retired June 30, 2020 after 6 years of service to ASU.

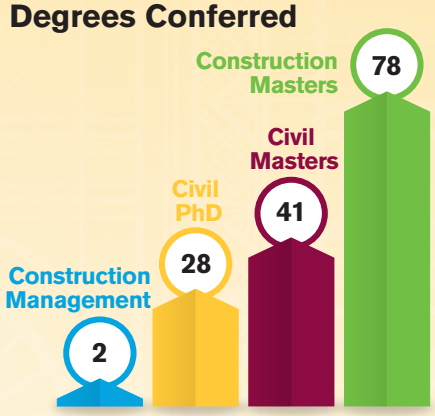
Thomas Dempster, Associate Research Professor, retired July 1, 2019 after 9 years of service to ASU.

SSEBE By The Numbers

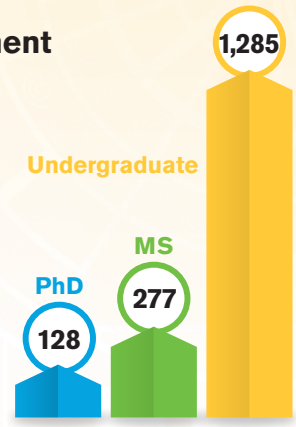
Undergraduate Degrees Conferred



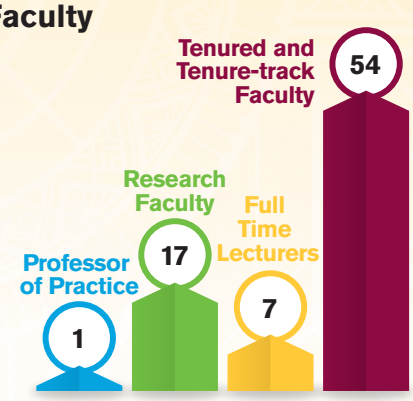
Graduate Degrees Conferred



Enrollment



Faculty



Total Scholarships and Fellowships Awarded 2020

$376,755

SSEBE Research Expenditures

$19,457,638

National Academy of Engineering Members

Edward Kavazanjian, Jr.
Bruce Rittmann

ASCE Distinguished Members

G. Edward Gibson, Jr.
Edward Kavazanjian, Jr.
Bruce Rittmann

National Academy of Construction Members

Samuel T. Ariaratnam
William Badger (emeritus)
G. Edward Gibson, Jr.

Canadian Academy of Engineering Member

Samuel T. Ariaratnam

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